

## Beyond Bolts: Architectural Details, Construction, Meaning.

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Submitted to the Department of Architecture on January 18, 1991 in partial fulfillment of the requirements for the degree of Master of Architecture at the Massachusetts Institute of Technology. February 1991

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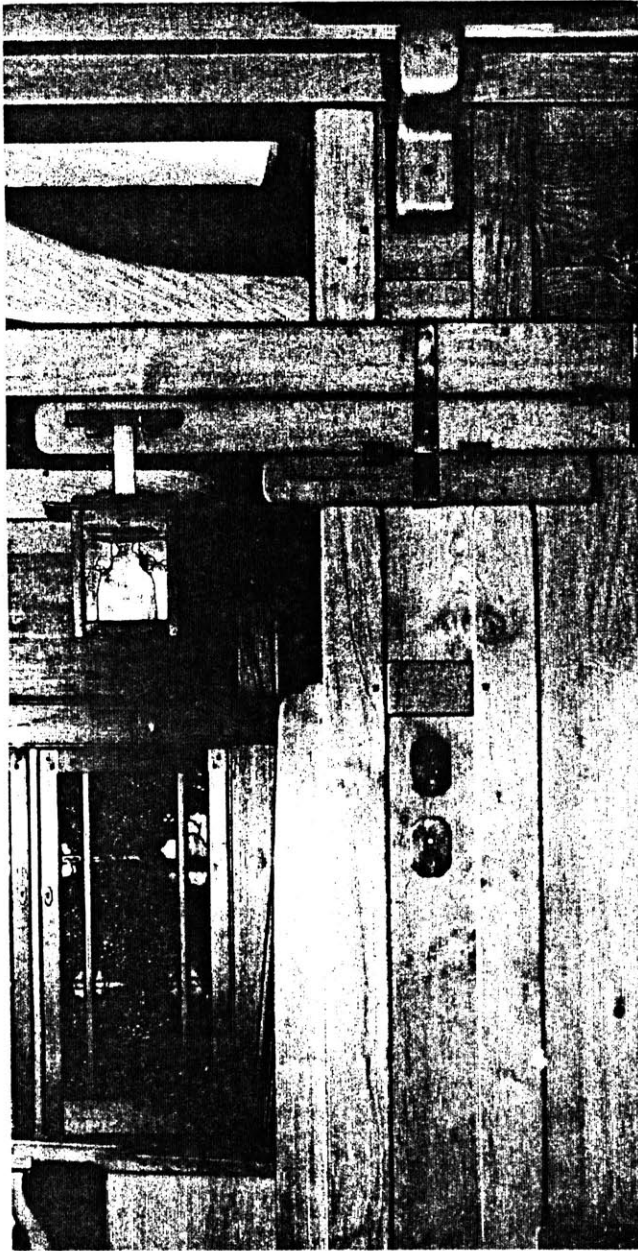
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## Beyond Bolts:

Architectural Details, Construction, Meaning.

### Abstract

An architectural Detail is a small piece of the whole, yet it has the power to characterize and define the entire building. Details tell us what a building is; they are fundamental to the life and personality of a space. Additionally, the design of a simple connection can and should be indicative of the designer's attitude toward the building in general; indeed, detail is architecture at its smallest size. The focus of this thesis will be the design of a small house and in particular, the elements of its construction. The intent: to explore how details can both solve construction problems and aid one's understanding of the house and help it gather meaning.

by Peter Dominic Weber

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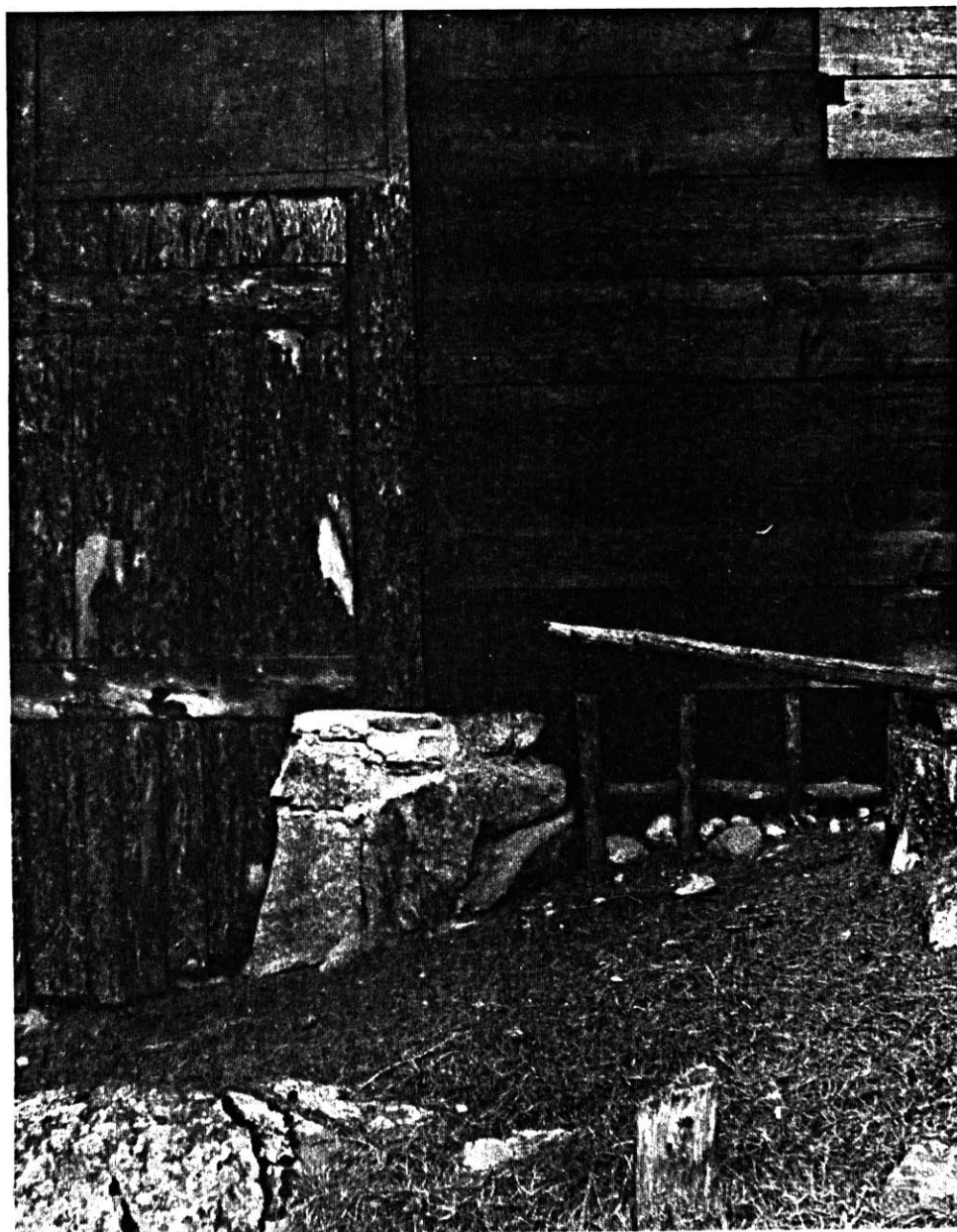
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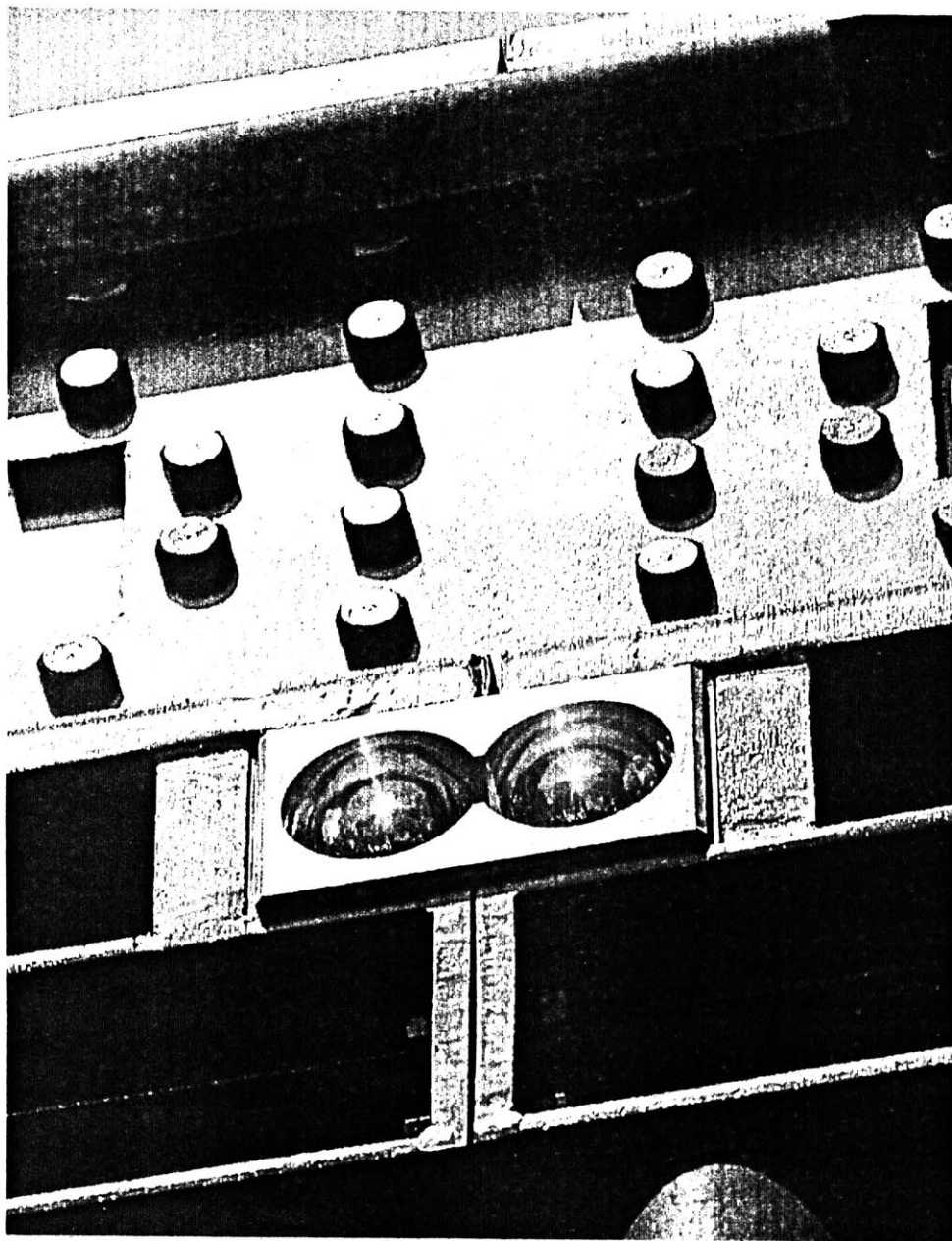




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so much depends  
upon

a red wheel  
barrow

glazed with rain  
water

beside the white  
chickens.

William Carlos Williams

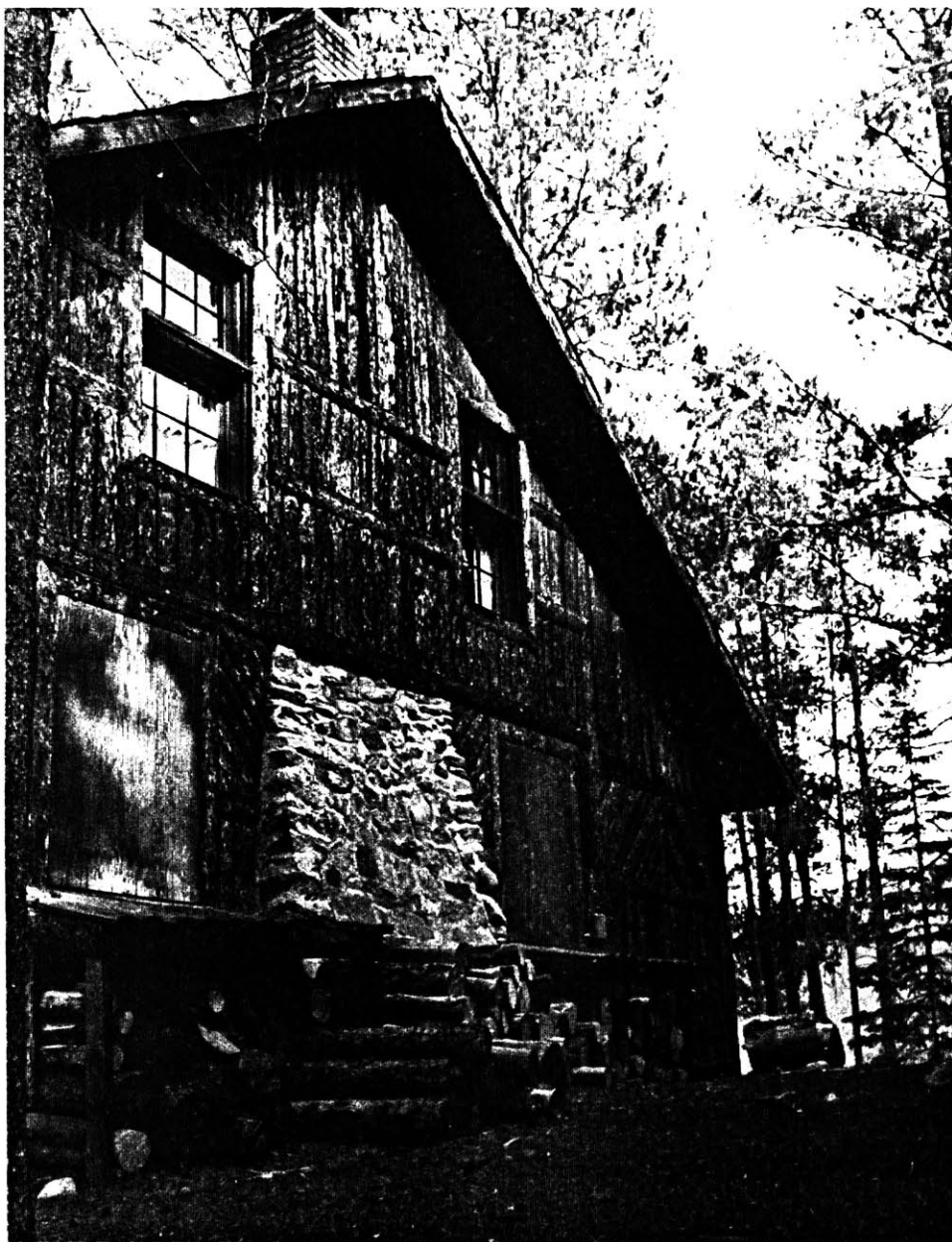
# Introduction

This thesis aims to explore the design of architectural details. Detail is defined as a small part in relation to a larger whole. The art of detailing is in using this relationship in the joining of materials, elements, and space in a way that is functional, understandable and meaningful.

Detail begins with construction and the need to solve some physical problem. In the past, smaller construction issues have been left to the craftsmen. This is a fundamental problem today: quality craftsmen are rare, as are architects who understand building. Only by participating in the actual act of building can one understand construction. By actually building details we are able to understand how construction can help dictate the form of the detail, and in fact how the detail can help tell the story of the construction. This construction must be made explicit if we are to be able to fully understand the building and how it is made.

To hide joints and connections under paint, mouldings and soffits add to the problem, for, if you can't see the construction, who cares what it looks like. A building is able to gather meaning through one's understanding of it, and if we are to understand a building for what it truly is, the details must be accessible and consistent with the rest of the building.

Frank Lloyd Wright once said, "The whole is to the part as the part is to the whole." Indeed, detail is architecture at its smallest size. In a building by Wright or Scarpa the details are consistent with and in fact integral to the other aspects of the building's design. If we ask why Scarpa puts space together in



In details are the possibilities of innovation and invention and it is through these that architects can give harmony to the most uncommon and difficult or disorderly environment generated by a culture

Marco Frascari

the way that he does we can partially answer by looking at his details. Just as the joining of two spaces creates a third space, the joining of two elements will give us a third element.

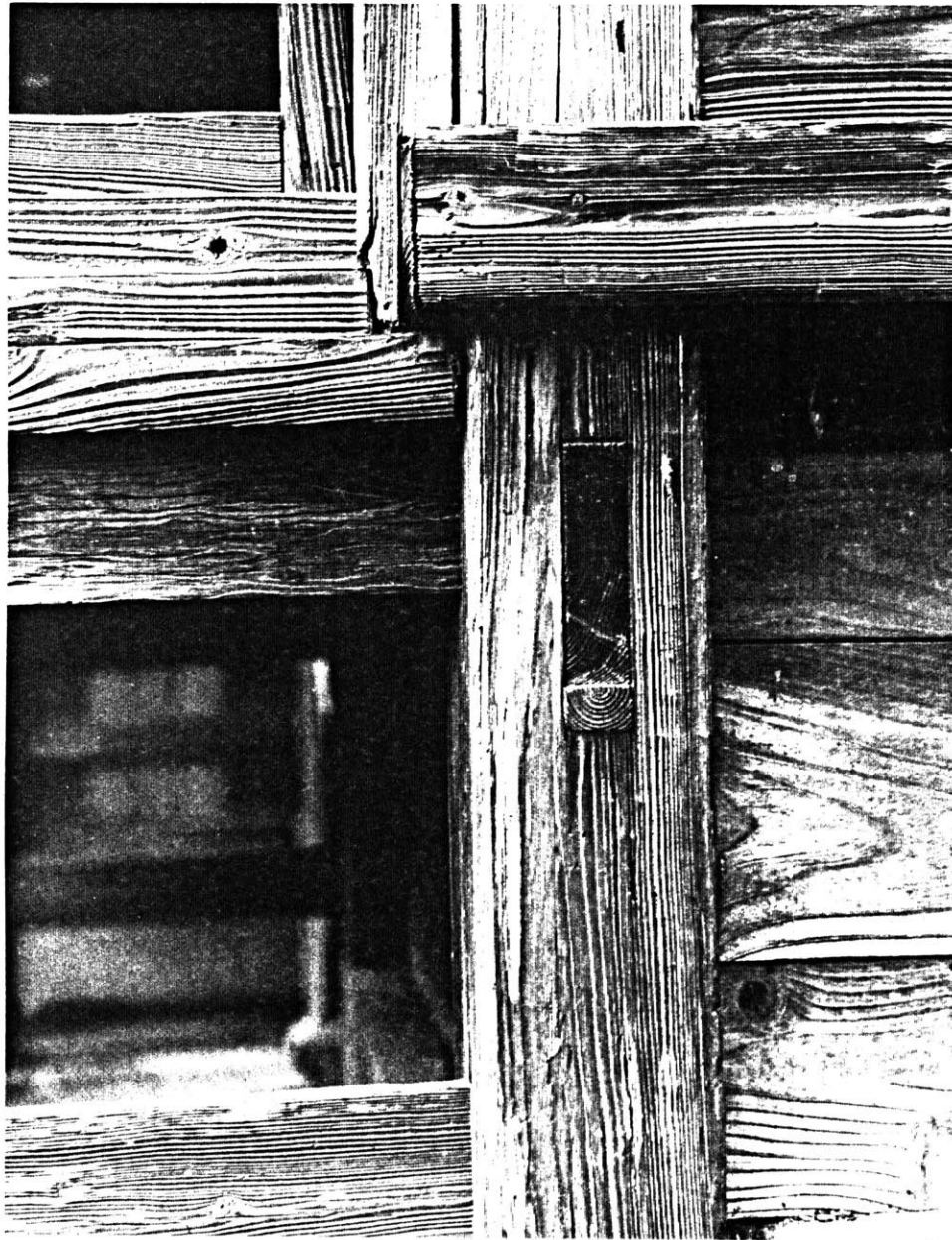
Scarpa, Wright and others knew the importance of detail and they used that knowledge and skill to create some of the great pieces of twentieth century architecture.

I firmly believe that only by exploring and understanding detail can we fully grasp the complete art of building.

In order to get at the issues involved in the design of details I worked on the design of a small house. The house became a framework which informs the detail design; and the details in turn informed the design of the house. For this thesis, then, the exploration of details has very specific parameters defined by an actual site, a real program, construction restraints, and material limitations. Following is an explanation of how all these factors are discussed in this thesis.

## **A House in the Rockies**

The first section is the design of the House itself. It includes an explanation of the site, the program--the project in general. This was a first pass at the design that began to define the house and suggest places where the design of details might be fruitful. This section will include drawings and model photographs depicting the resulting design and explaining the building system.



Careful detailing is the most important means of avoiding building failure, on both dimensions of the architectural profession - the ethical and the aesthetic. The art of detailing is really the joining of materials, elements, components, and building parts in a functional and aesthetic manner.

Marco Frascari

## **The Formation of Details**

This section will discuss the issues and particular criteria that were considered in the design of the details and will present their design. It explains that we find the need for detail design within the larger elements of the building: the walls, floors, roofs, foundation; as well as the connection of those elements: the floor meeting the wall, the wall joining the ceiling or roof, and so on. The designs presented will be of the elements and the connections between them. The goal is to discover how the factors influencing these connections can lead to a better understanding of not only the given connection, but of the elements being joined as well. Included will be process sketches, model photographs, and drawings explaining the issues and design decisions that were made.

## **House Design II**

Discoveries made in the design of the various details of the house led to a need to redesign the house itself. This section will contain a discussion of those discoveries and a presentation of the second design. I will attempt to explain how that design came to be different due to the exploration of the details.

## **Conclusion**

A review and discussion of Details and their integral relationship to all architecture.





## A House in the Rockies

There is some of the same fitness in a man's building his own house that there is in a bird's building its own nest. Who knows but if men constructed their dwellings with their own hands, and provided food for themselves and families simply and honestly enough, the poetic faculty would be universally developed, as birds universally sing when they are so engaged?

Henry David Thoreau

Architectural details occur in very specific places. These are, to some extent, generic: a column meeting a beam; a floor meeting a wall; a column meeting the ground. However, I needed to know what column it was, where it stood in the structure, and where that structure stood in the world. Therefore, I chose to design a small house for my parents. In retrospect, this was perhaps too close to me, but it did give me a solid base that I already knew very well. The site, program, and users are all given and they are all real.

In our family there has long been the dream that someday we would have a house in the mountains where we would be surrounded by snow on the outside, but bathed in firelight on the inside. It would be a place where we would go to escape from the hustle of everyday life--a retreat, among family and friends. The chief perpetrator of the dream was my father. For him the dream itself was a retreat, a place he could go in his mind, if not yet in reality. Every year we would take a family trip to Colorado or Montana (we lived in Minneapolis) and then the talk would begin: "...wouldn't it be great if we had our own place..." On one of those trips we stumbled across Grand Lake, Colorado; in the summer we went back and acquired the piece of land upon which to build. That was six years ago. Since that time I have done two more or less complete designs for the house; this is the third.



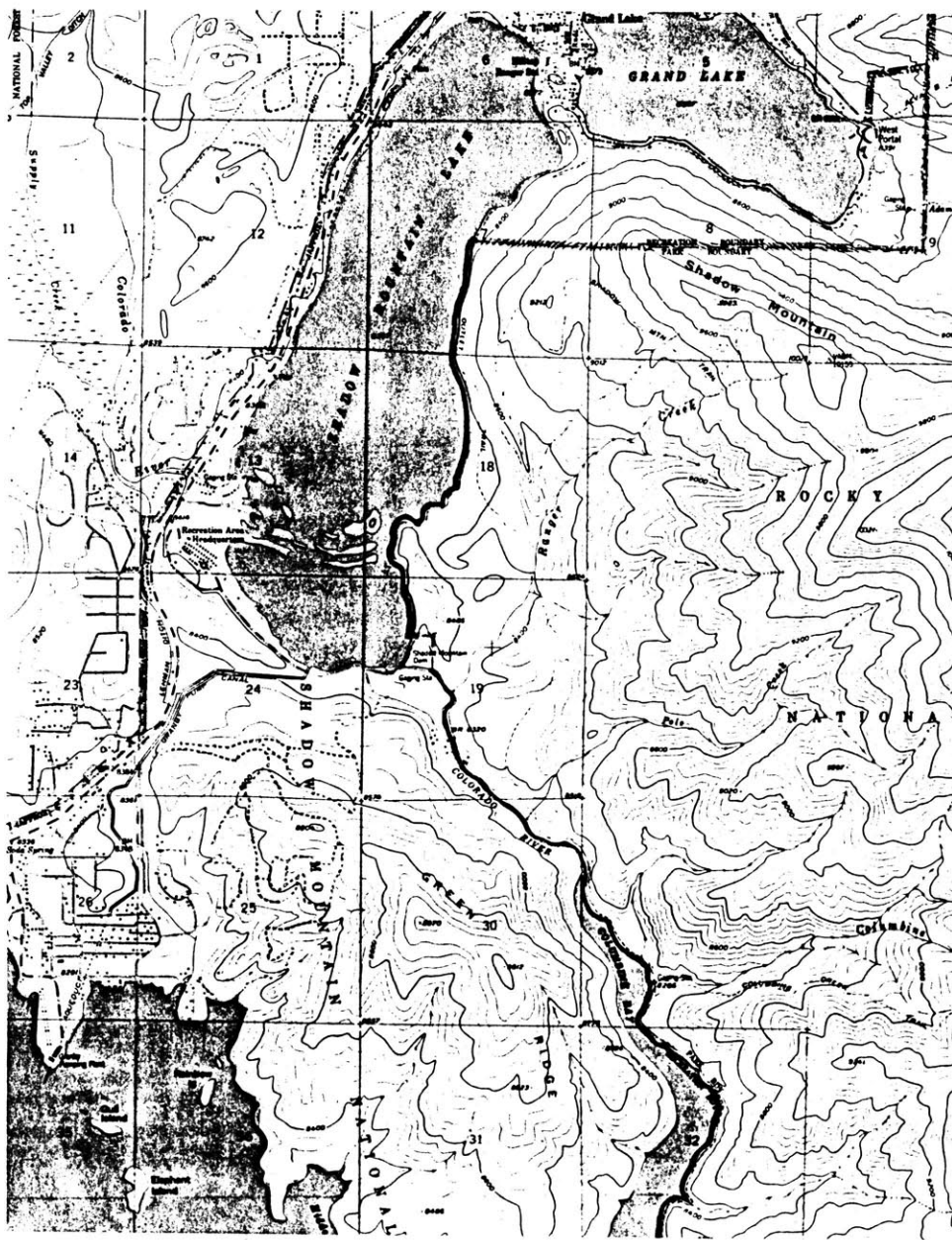
## The Site

The piece of land we have is about  $\frac{3}{4}$  acre in size. It sits on top of a small rise which faces mostly east. To the east is Shadow Mountain Lake, backed by 13,000 foot mountain peaks. This is the main view. There is also a view to the west over a swampy basin to the somewhat less majestic mountains beyond.

The vegetation is almost solely lodgepole pine, with some scrubby pine ground growth and an occasional aspen. The trees are rather thick: the sun penetrates only in the early morning, high noon in summer, and late afternoon. The light is always filtered through the trees. Surprisingly, wind is not much of an issue here, but when it does blow hard it comes from the north and west.



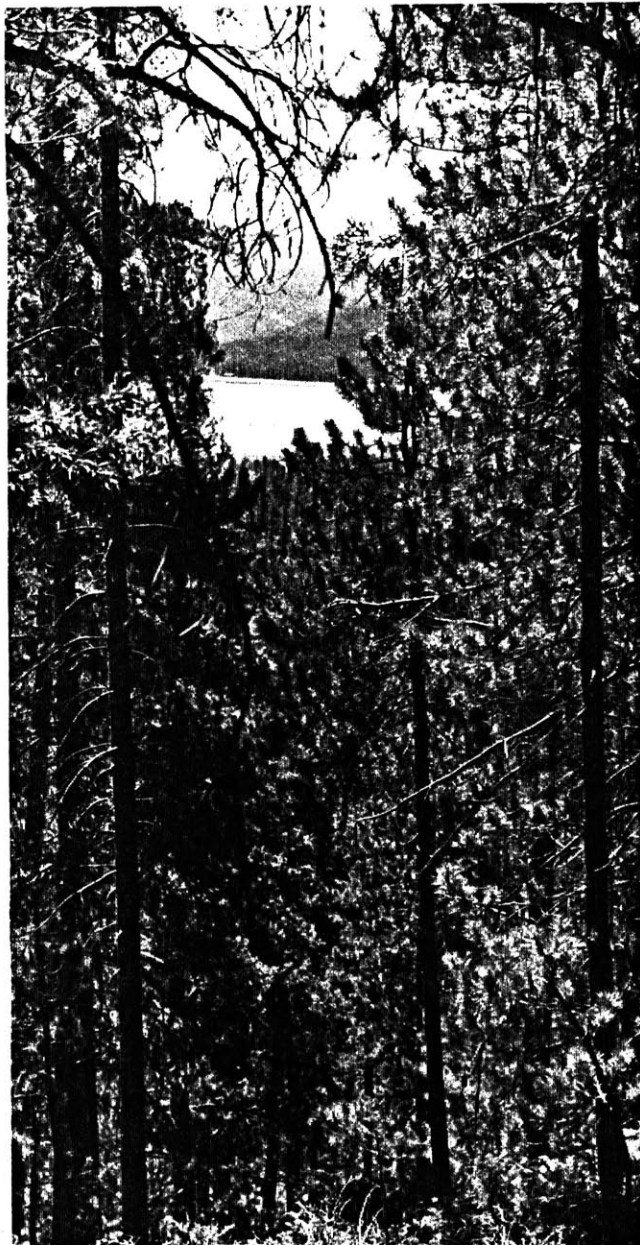
The elevation is 9,000 feet above sea level, making it a rather cold place in winter. An average winter day would have a high temperature of 20-30 degrees Fahrenheit and a low of zero or below. Summer is quite pleasant, getting warm but never hot. The sun at 9,000 feet is very intense and accounts for most of the heat, and causes large daily temperature swings. In summer the average high is between 70-80 degrees, rarely reaching as high as 90, and the lows drop to a chilly 30-40 degrees Fahrenheit. This elevation also sees a lot of snowfall, up to 200 inches a year. The air is dry year-round and there is very little rain in the summer, despite the afternoon thunderstorms that are common in the Rockies. For five to six months of the year, it is actually a rather severe climate. The one thing that makes it liveable is the sun, which is very strong and shines 75% of the time, even in winter.



It was during one such battle that the lake received its Indian name. Upon learning of an imminent attack by the Arapahoe, the Utes built a raft for their women and children, hoping to ensure their safety by sending them out to the middle of the lake. Tragically, a storm blew in and capsized the raft, drowning the families of the Ute warriors. After the battle, the grieving Utes named this body of water "Spirit Lake" and left the region forever. Later, the name was changed to Grand Lake. However, local legend has it that the screams of the Indian spirits can still be heard coming from the depths of Spirit Lake.

Grand Lake brochure





The soil type is glacial moraine, which was described to me as "everything the glacier left behind." It is composed of sand and gravel and rocks--from the size of your fist to the size of a truck. This makes excavation difficult and expensive, but does provide an interesting landscape.

Grand Lake is an intriguing town--it's about two miles from the site--a mixture of cowboys and summer tourists from Denver. The lake itself is the largest natural lake in Colorado, drawing many vacationers to its shores. The wealthy "flatlanders" from Oklahoma, Kansas, and Nebraska, as well as Denver, came to Grand Lake and built lavish summer cottages along its shores. These homes combine with a mining/cowboy town atmosphere to give Grand Lake its unique character.

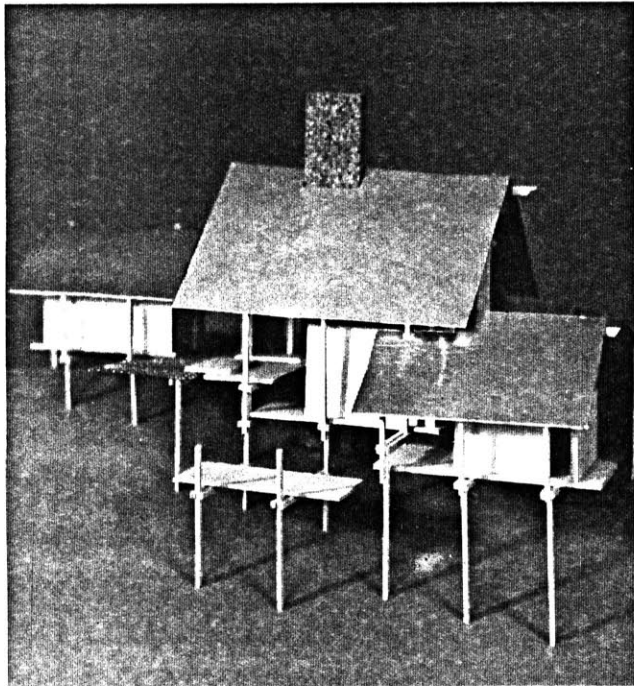
### **Program**

The house is to be small--1,500 square feet maximum, with a kitchen, a small den-like living room, a large eating/work area, a large bedroom, one bathroom, a small office, and upstairs loft. The qualitative aspects desired are defined by my parents:



To anticipate, not the sunrise and the dawn merely, but, if possible, Nature herself! How many mornings, summer and winter, before yet any neighbor was stirring about his business, have I been about mine!...It is true, I never assisted the sun materially in his rising, but, doubt not, it was of the last importance only to be present at it.

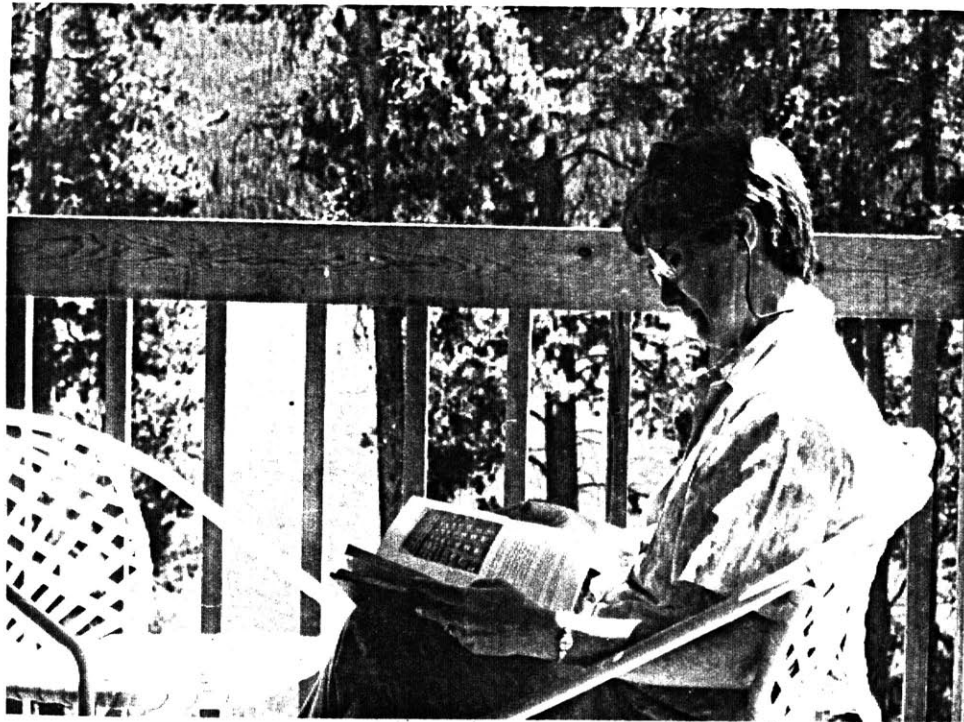
Henry David Thoreau



"...considering the ruggedness of the building site I think we need to capture the same feeling in the construction using natural materials--rough-hewn but not massive, to provide a connection with Nature; and somehow combine indoor intimacy with the outdoor experience.....Organize the interior space around the light, the fireplace.....I could for example envision a window seat arrangement.....I also like the idea of breaking up the interior space by changing levels if it would not be too difficult. I would imagine the interior to be pretty open and there may be a way to define space without use of full walls, in some cases.....What I don't want is a hodgepodge, something that looks like it's been thrown together; I want it neat, orderly, fit together like everything belongs.....I would see one main deck, not overly large, maybe 8' X 10' or 12', located at the SE corner of the house, set in as a defined space, as opposed to it for example running all the way across the front of the house. I don't believe I like that idea; I believe the deck should be at least partially protected by two walls.....I like the idea of exposed wood beams joined neatly together to expose the innards of the house structure, tying it together, so to speak, like a timber frame but with less mass.....I especially desire the sun and light--early morning and late afternoon--it pulls me toward it somehow.....Obviously I would like a natural stone fireplace in the living room..."

-Bill Weber





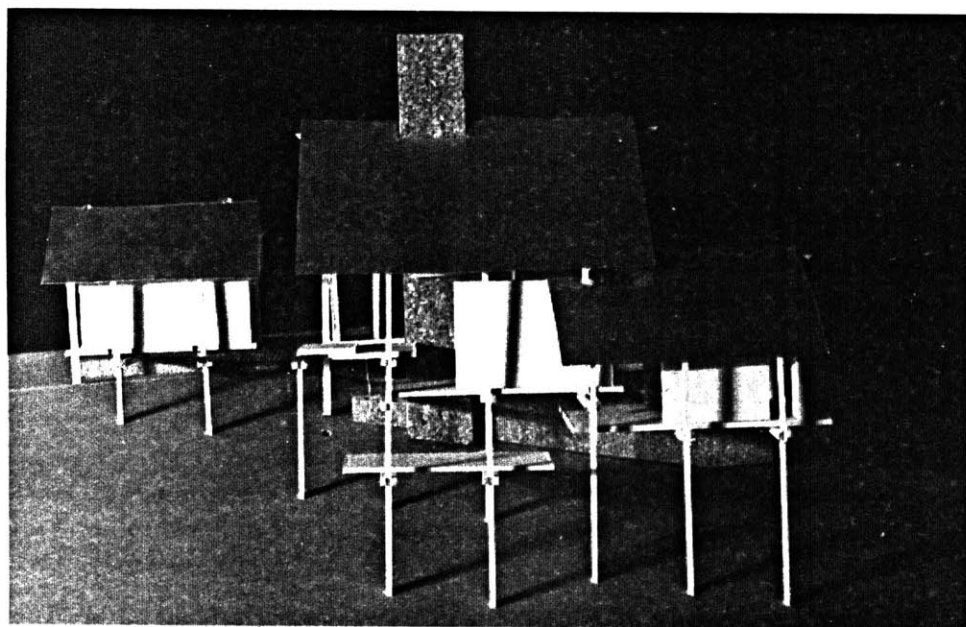
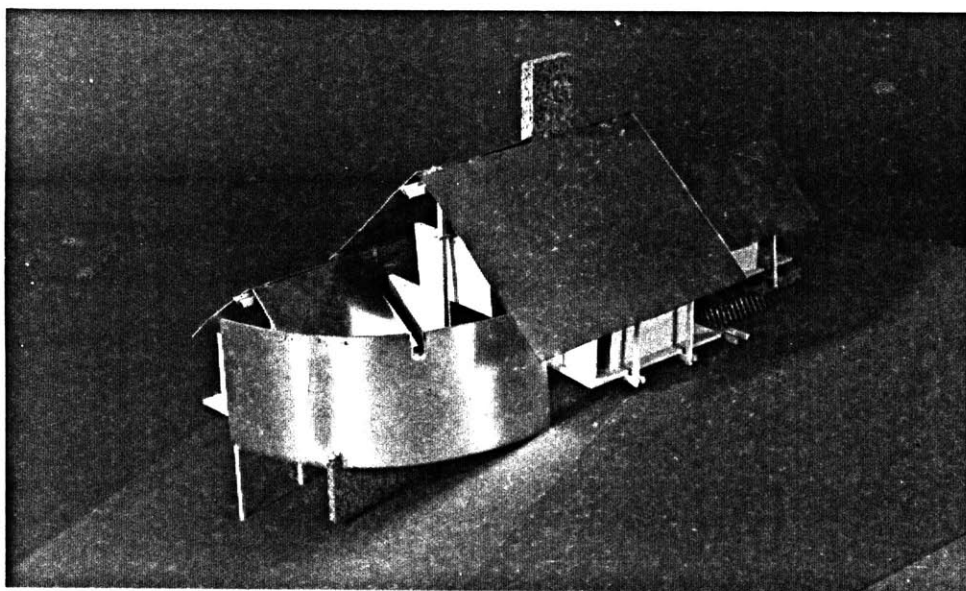
The house after all is only the shell and the real interest must come from those who are to live in it. If this is done carefully and with earnestness it will give the inmates a sense of satisfaction and rest and will have the same power over the mind as music or poetry or any healthy activity in any kind of human experience.

Bernard Maybeck

"...In the ski house I know Dad and I are going to each need our own space--a separate room/space that is our own, and not the other person's, with a closed door. If the bedroom has a comfortable nook/chair where I can go when Dad has the football game on....

...what I like about the Harbor View Cafe: the lighting, the books covering the walls, the wood. It appears to be old wood; whether it is or not doesn't matter, but I like the way the lighting makes the wood shine, glow, or whatever effect that is: warm, inviting, makes us want to linger over dinner, stay a long time.....

....I like Lee's Great River Farm because the rooms are small and manageable--cozy, warm, not ostentatious, nothing flashy. I like the wide window sills a lot. I like his placement of china and ceramics; I like his little touches, in other words. I like the colonial windows. It would certainly have a different look if plain windows were put in, like they did next door. I love the porch. We have to have a porch or closed-in deck or something.



...one cannot settle in the world  
without assuming the responsibility  
to create it.

Mircea Eliade



....Remember Grandma McCarron--how she would watch for us and listen for the car to drive up, sometimes even be on the porch sitting on the steps, especially if we were later than we said....

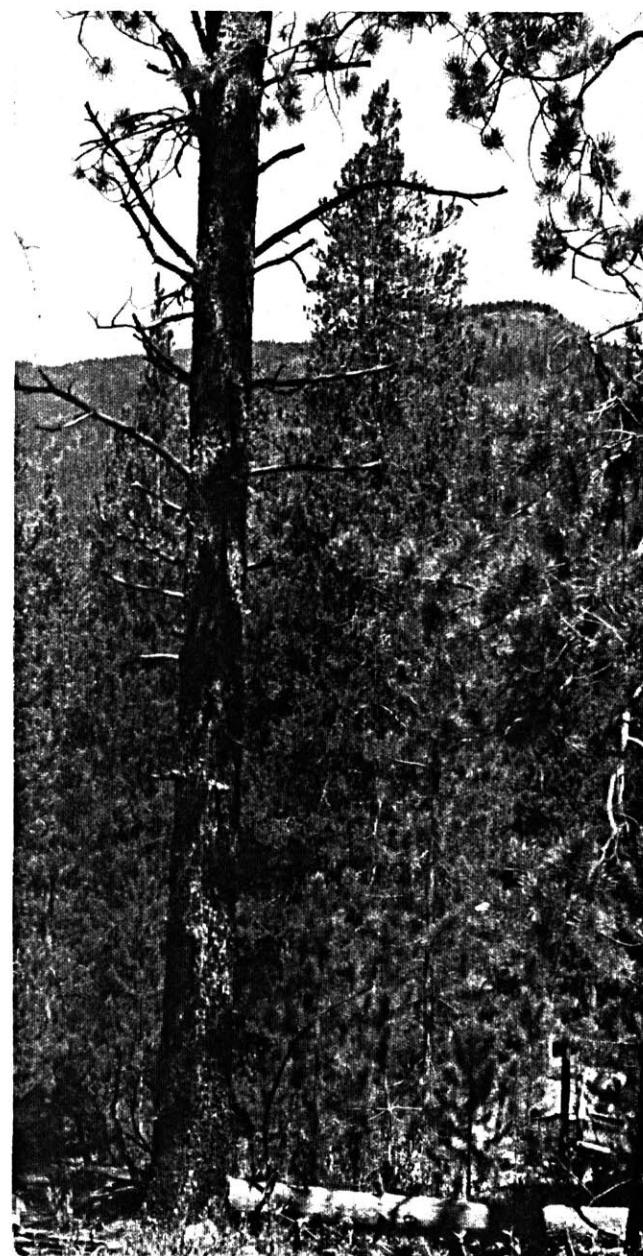
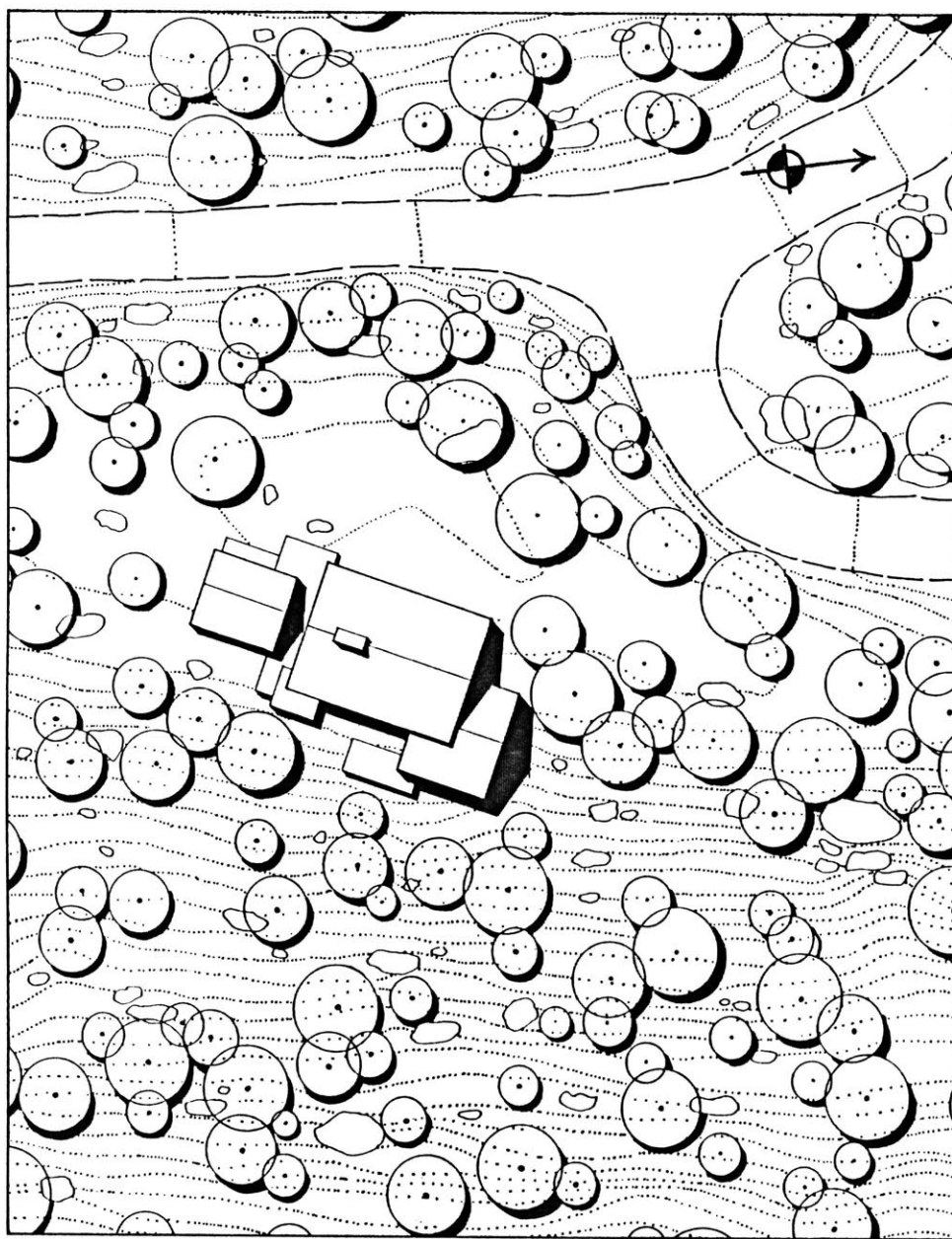
...I can almost picture our place in G.L. I visualize it a lot and see: wood, glass, china, quilts, chintz coverings on chairs and sofas--floral of course, worn rugs--oriental?, throws, blankets, sweaters.

....The lighting I like is natural yellow glow from table lamps, floor lamps--no overhead unless it's small.

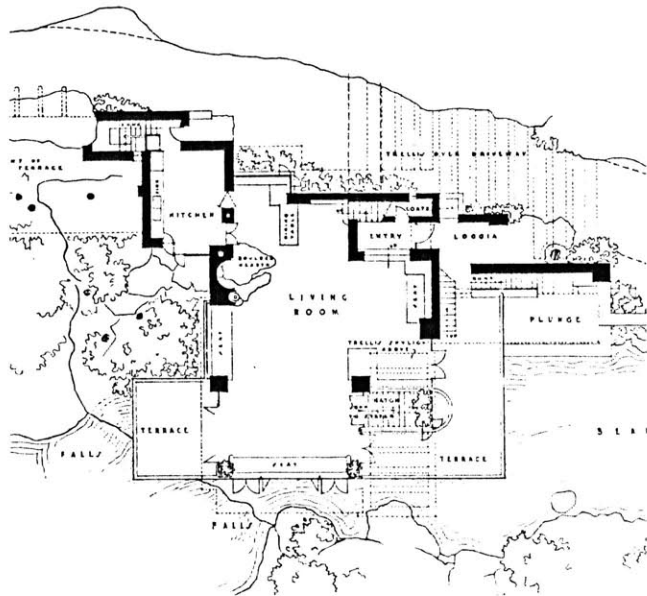
.....The charm, attraction with that place is the 1. wood, 2. lighting and 3. books. (and oh, the cash register ringing. It has a distinctive ping to it) So if we can get those three things incorporated into a mountain house we'll have it.

...The feel of a wonderful spot to come home to, settle in, put the kettle on, talk, cook, read, nap...."

-Camilla Weber



## Preliminary Site Plan (facing page)

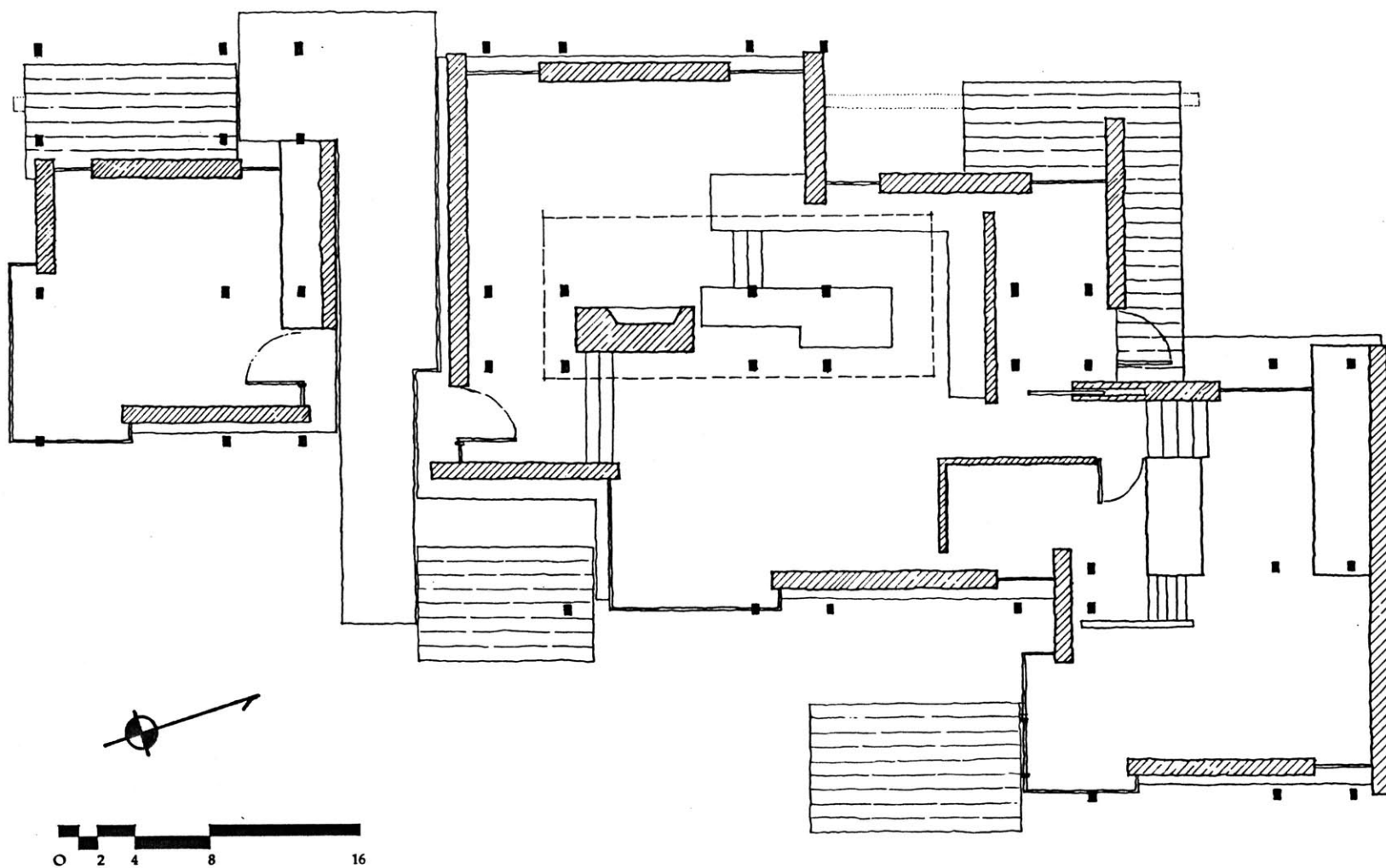


## Building System

The image I have of the building system is like that of a good down parka. The structure is provided by the skeleton of the person wearing it. The heat is generated within and kept in by the thick layer of insulation that surrounds it. The building system consists of foundation, frame, floors, walls, roof, and openings. An attempt was made to make each of these elements behave autonomously while still working as a whole. One of the fundamental notions I've been working with is the separation and articulation of function; that is, each aspect of structure, closure, compression, tension, etc. is articulated in the design, allowing for a complete understanding of building. This attitude carries through to the design of the detail as well. A brief description of these elements follows.

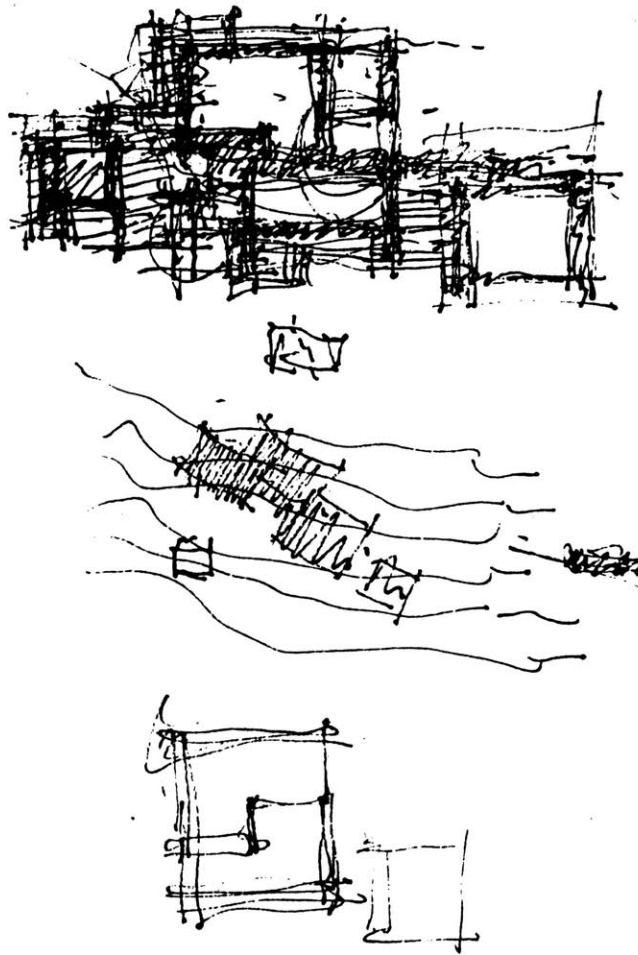
**Foundation** The foundation consists of two elements: grade beams and piers. The grade beams are located at the top portion of the hill and are intended to ground the building. The pier foundations are at the front/downhill side of the house. They are really just concrete coming up out of the ground to meet wood posts that will go up to support the frame above. This is a minimalist foundation dictated partially by the need to excavate as little as possible, due to the soil conditions. The result is that the house sits up off the land. The foundation changes significantly in the second design; the house will sit more in the hillside.

**Frame** The frame is the real structure of the building, taking all the gravity loads. The elements of the frame are: 6"X6" and 4"X4" posts spaced on a 10'-12' module; doubled 2"X12" beams supporting the floor joists and roof rafters; connecting/





## Preliminary Floor Plan (facing page)



stabilizing members ranging from 2"X4" to 2"X10" as needed. The size of wood members is limited to what two people can handle with relative ease, and to sizes that are readily available.

**Floors** At this point in the design the floors are rather simple. The only special consideration is that they need to be thick and well insulated. We need at least 12" of insulation. Again, we will use easily acquired materials: 2"X10"-2"X12" for joists, and plywood for sub-flooring and shield to the exterior.

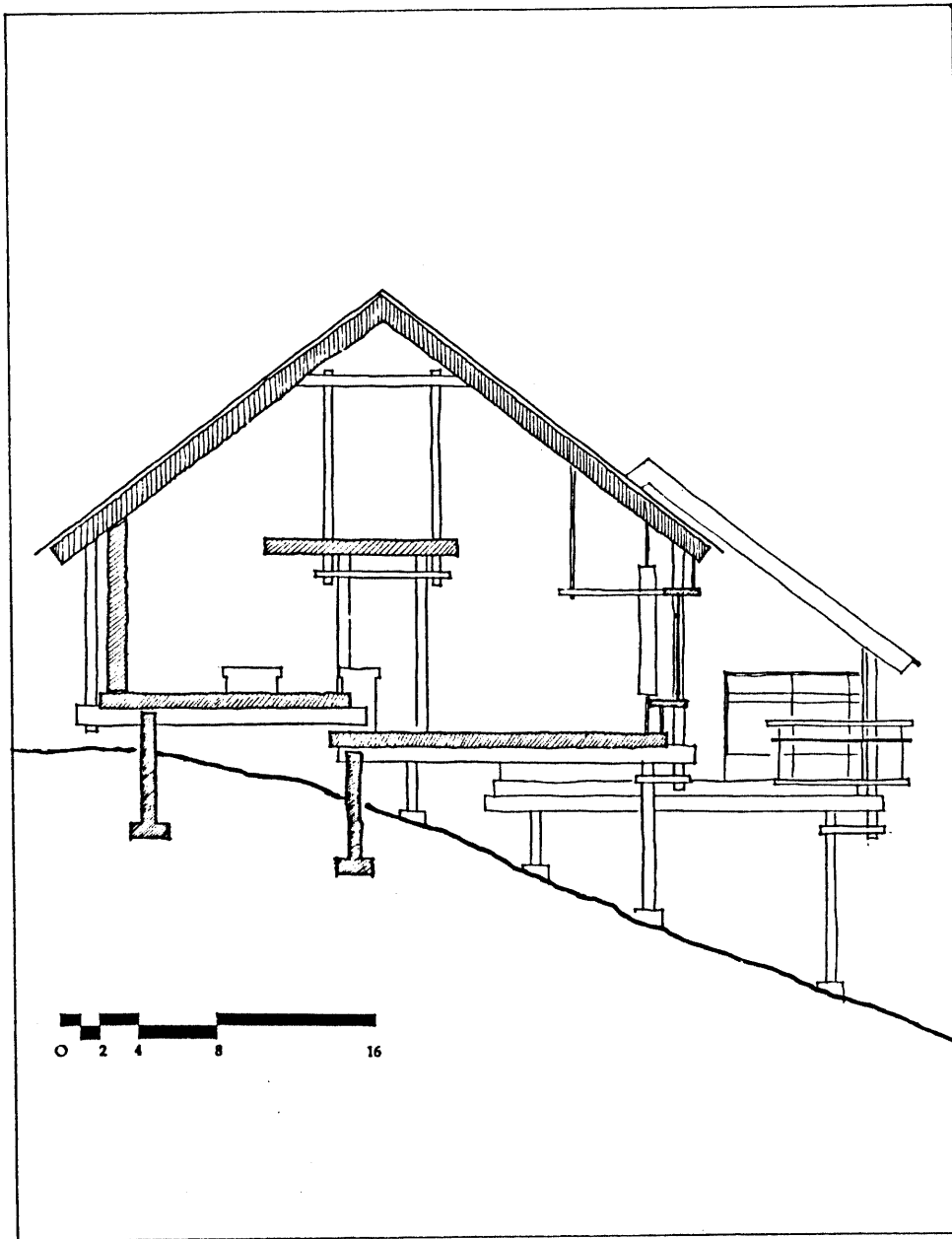
**Walls** The walls are supported by the frame and need very little structure of their own, just enough to support themselves. The walls serve as a closure to the weather and as such are a barrier to wind, snow, and rain, as well as cold. Thus, the walls are thick, box-like elements, 12" deep, with a vapor barrier, exterior siding, and interior finish.

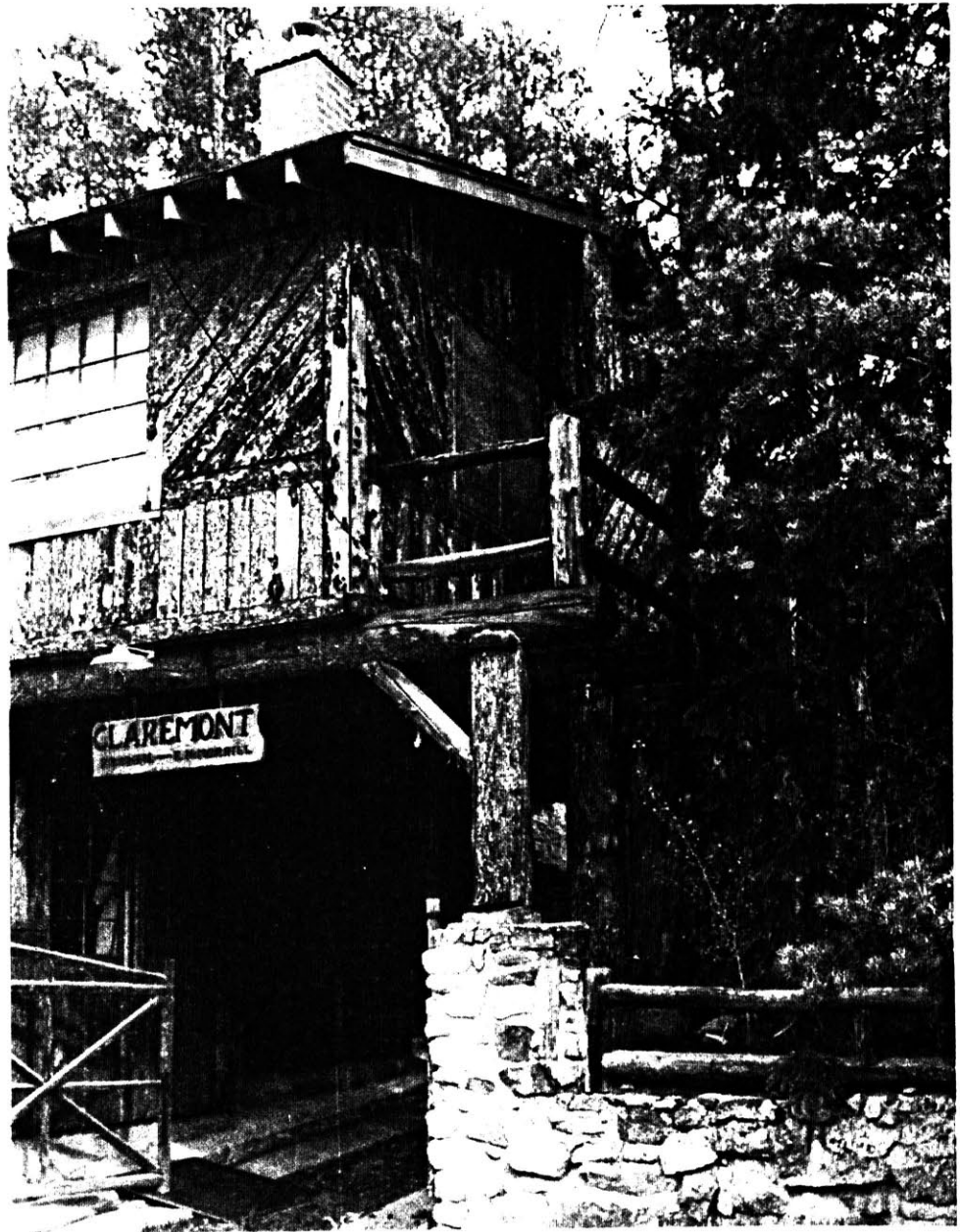
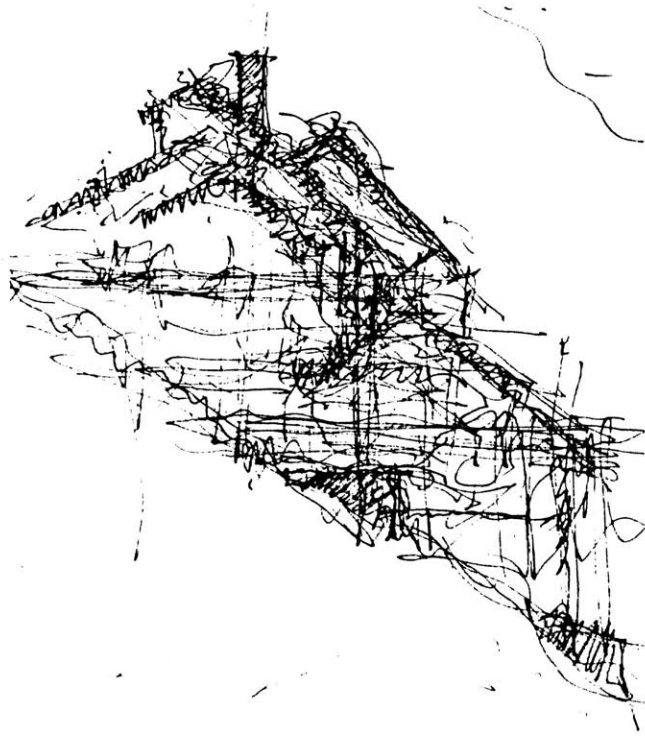
**Roof** At an elevation of 9,000 feet in the Colorado Rockies, the roof is perhaps the most important element. The roof must protect against the weather, like the floor and walls, but it has the additional task of shedding the snow, which can be substantial. The roof will therefore have a pitch of approximately 9:12 and will have a metal finish, allowing the snow to slide off. The roof will be ventilated to avoid ice damming. The roof will be thick, again made of 2"X10"-12" materials, with plywood sheeting.

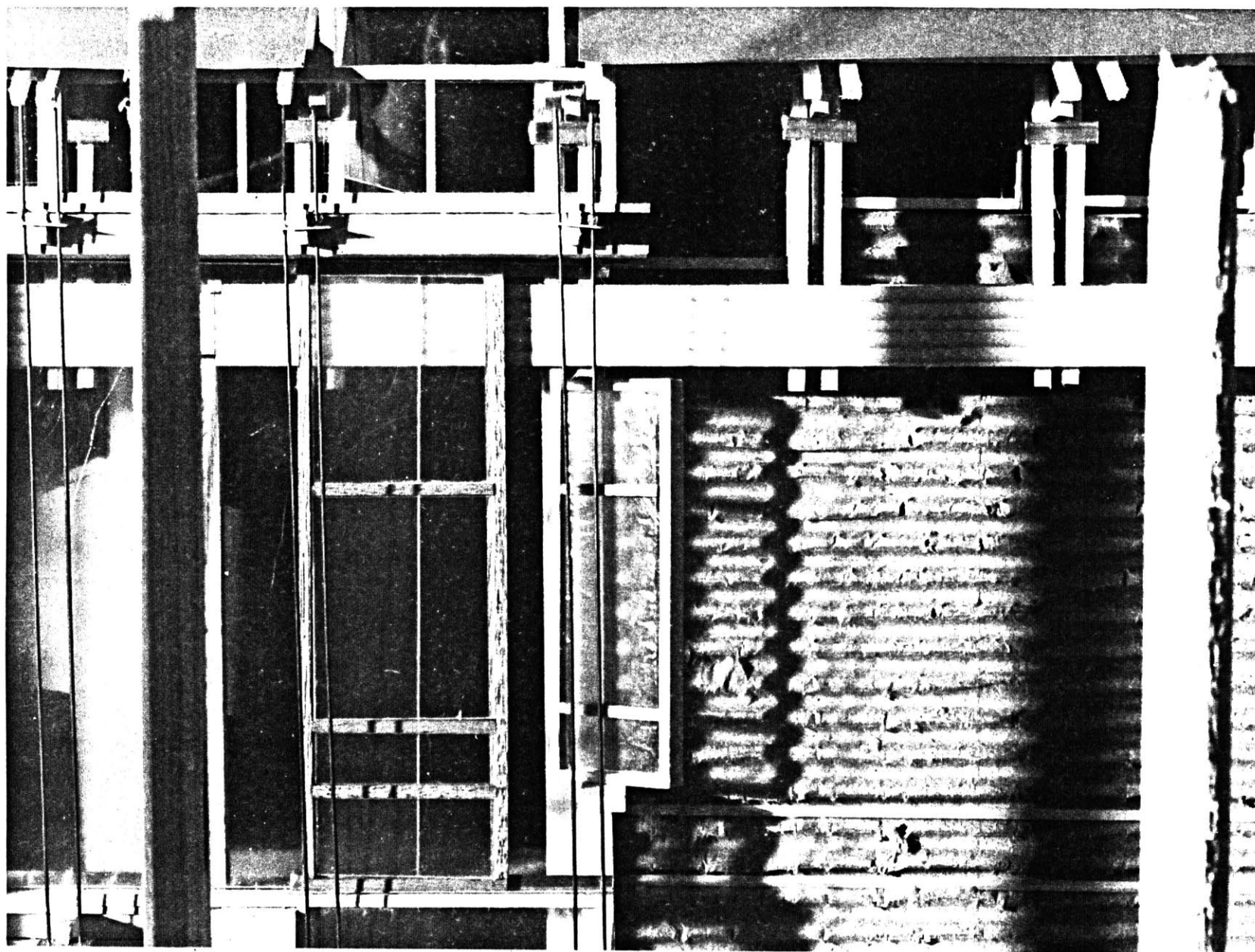
**Openings** Openings include doors, windows, and skylights. The openings occur in two ways in this house: as breaks between elements, and as holes in elements. For example, windows occur both in the walls and at the juncture of two walls. Almost all openings are between elements, allowing for a clear reading of each element. Details to follow.



Preliminary East/West Section  
Looking North







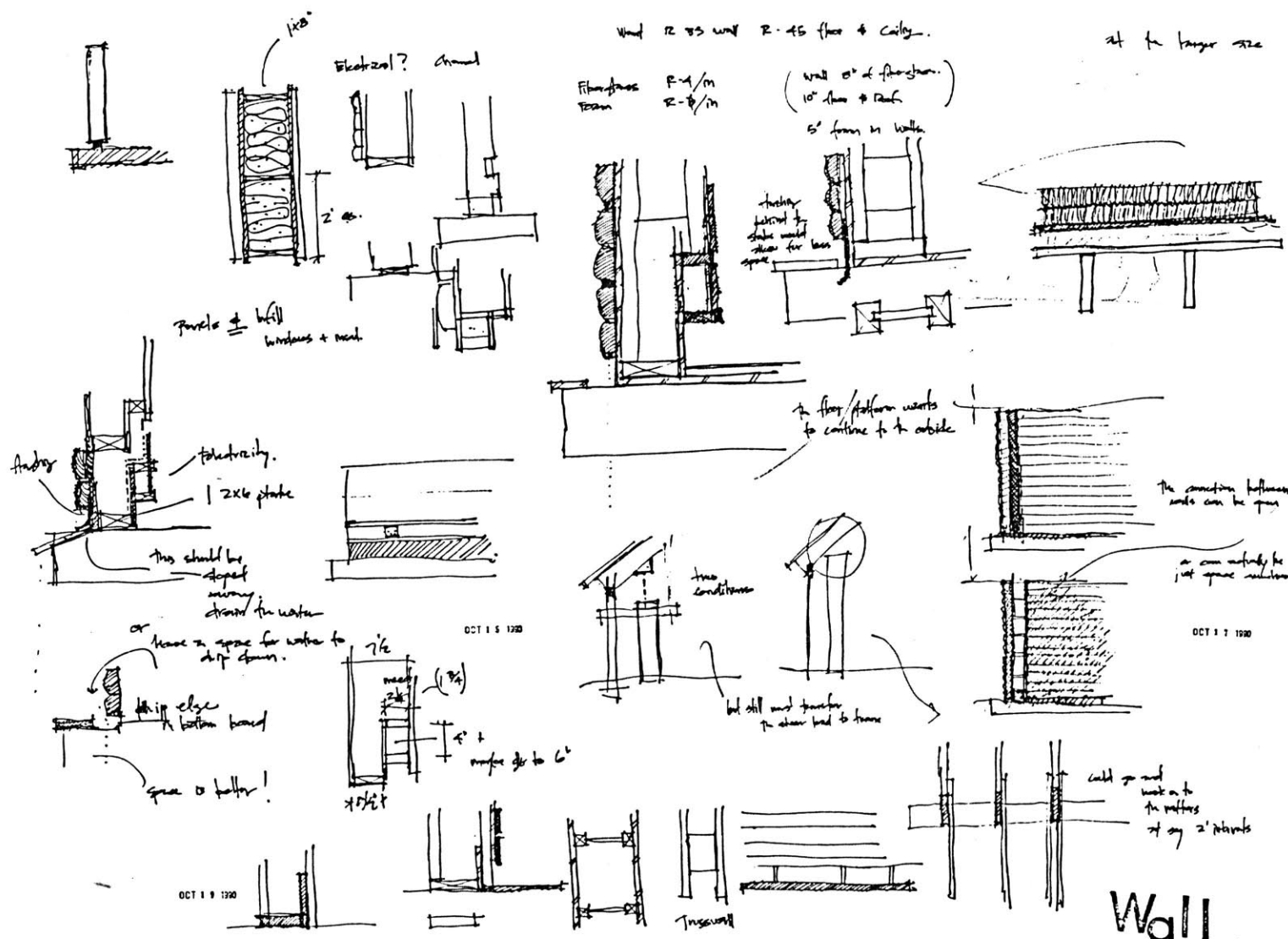
## The Formation of Details

In the main the ornamentation is wrought in the warp and woof of the structure. It is constitutional in the best sense and is felt in the conception of the ground plan....it is the most fascinating phase of the work, involving the true poetry of conception.

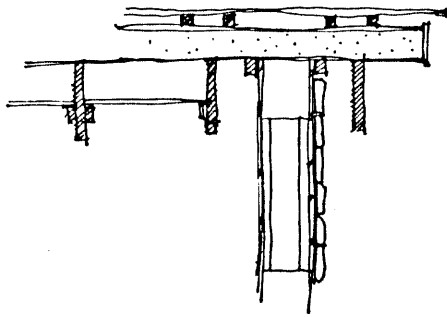
Frank Lloyd Wright

Detail is defined as a part of the whole, a part considered separately from the whole. They are the small elements that collectively give a work its final character or image. In architecture details occur where there is a meeting of two or more elements. The artistry is in joining those elements. In all great architecture the details are integral to the whole building design. We cannot design a building without them; the smaller elements must be designed just as the plans, sections, and elevations. First we must have some idea of the building design as I have done in the first part of the thesis. Then as we begin to refine that design and further define its spaces, the details come into play.

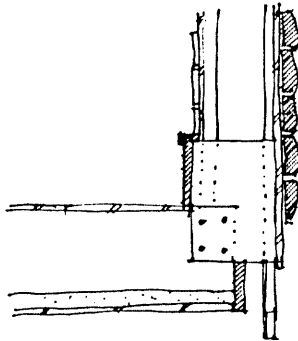
Once we know the qualities that we want to engender a space with we go about design in a number of ways: arranging the floor plan; setting the ceiling heights; we deal quite specifically with sizes and dimensions. Now we develop a building system that will help provide the desired qualities while solving the technical issues of structure, closure, etc. At this point we need to address how this system is constructed: the design of the details is not simply a solving of the physical problems; they must be designed with the same concerns and conditions that inform the building as a whole.



There was a time when the details were left to the craftsmen and today too, this is done to some extent. This assumes that the craftsmen and the architect are mutually aware of each others' abilities and design wishes. In the majority of American single-family house building this works fine, but when we step out of that mode, if our design needs fall outside the range of conventional construction, we must consider the details at every stage of the design process.

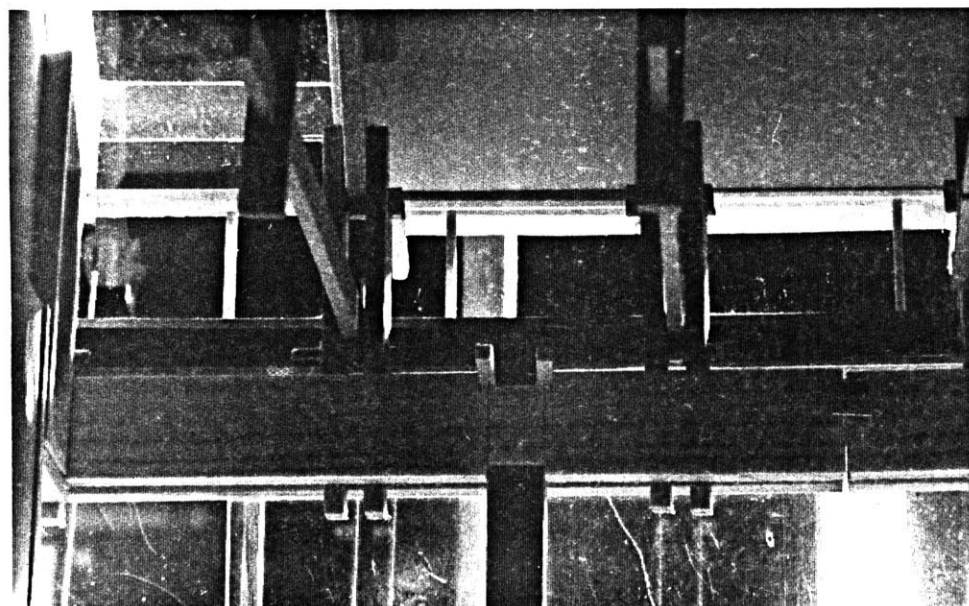
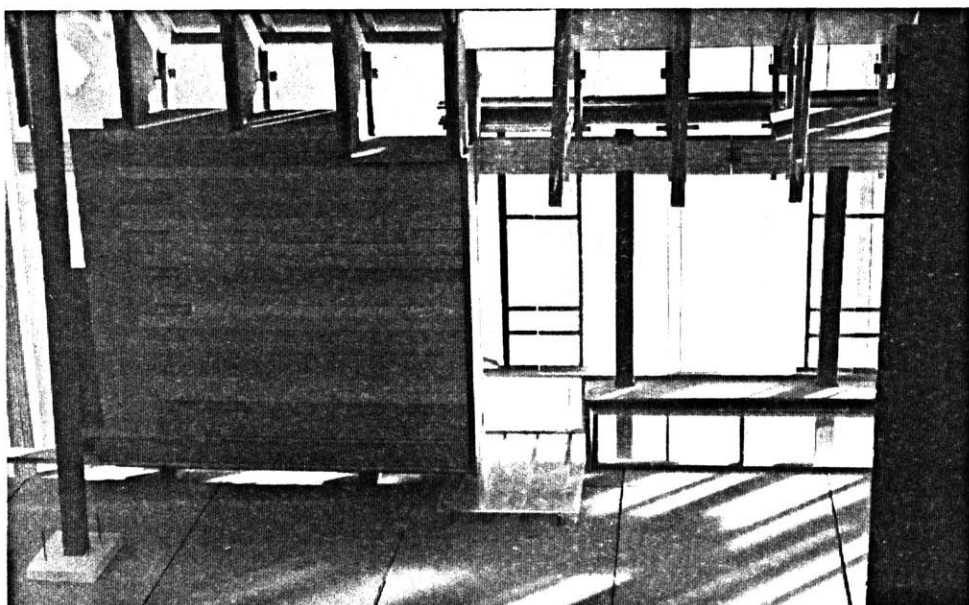


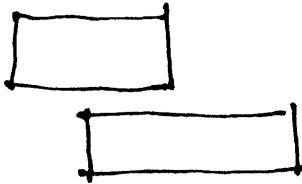
There are two conditions in which architectural details occur: within an element and in the connection of that element to another. Take a wall for example: we must know the construction of the wall itself, what its structure is, how it keeps the weather out, what its interior and exterior finish is like; we also need to know how it connects to the floor and roof above.



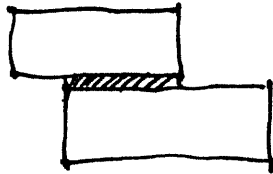
The example of the wall details illustrates the integral nature of details. We may suggest a wall construction that cannot provide a satisfactory connection with the ceiling. That wall must then be rethought with the issues of ceiling detail in mind; then we must consider the ceiling construction and so on. If we do our job well, both the element (wall) and its connections will be of the same character. The design of each will inform the other and the result will be a system that is a natural, unforced, and appropriate solution to the given problem.

There are innumerable ways of solving any design situation. This is true at the largest scale as well as the smallest; at the smallest scale we are concerned with the joining of materials. While there is a vast number of possible solutions, we can recognize several generic categories:

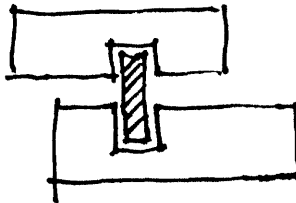




**Material Discontinuity** Two or more elements interact at a given location but there is no actual physical connection. This type of joint is not expected to provide resistance to weather or structural forces. There is no concern for tolerances, and expansion and contraction are not a problem. This allows for uncomplicated construction.

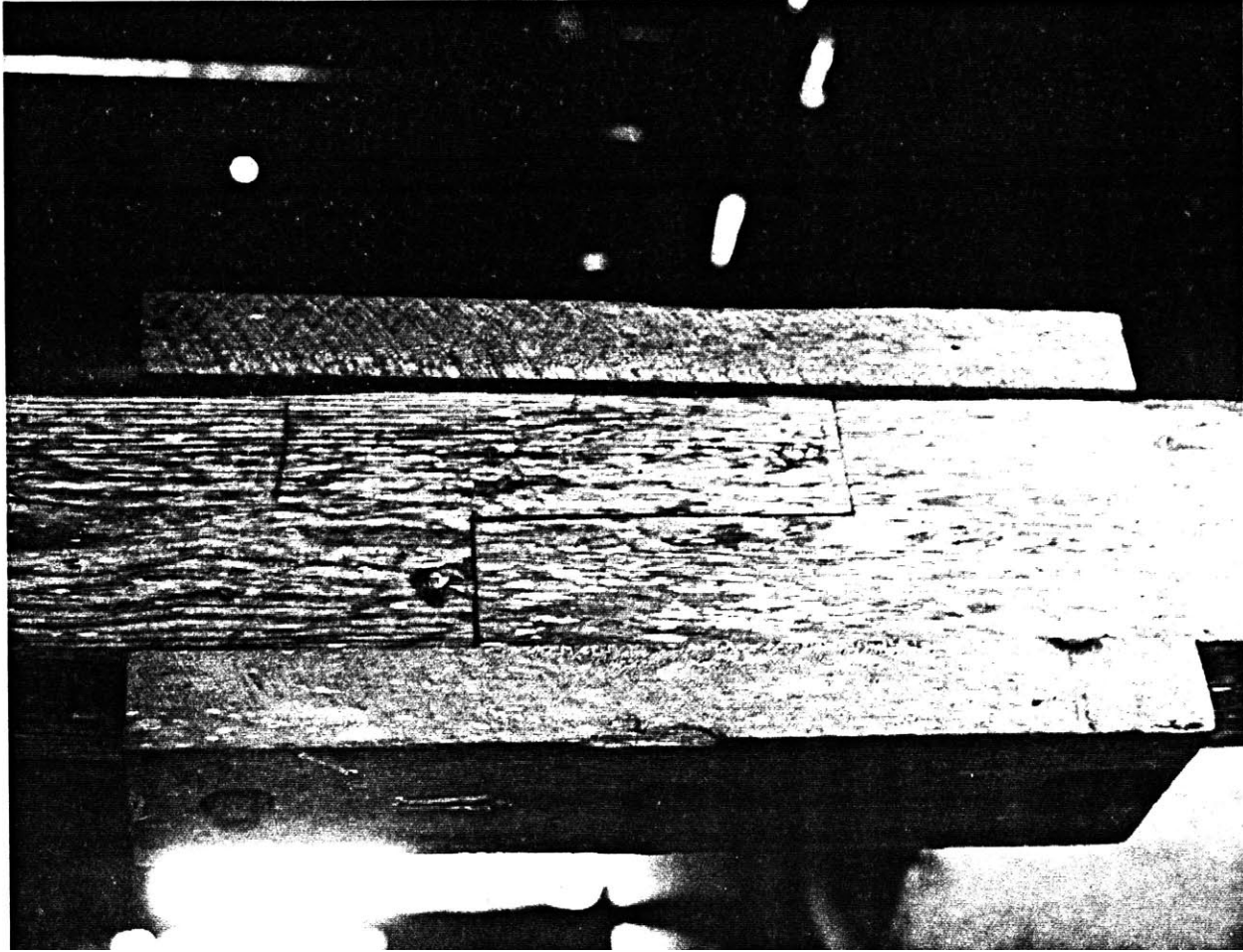


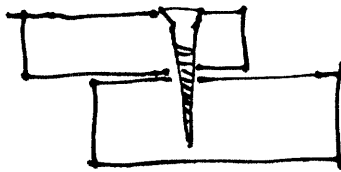
**Adhesive** Here the elements are glued together. An adhesive is placed between the two surfaces and joins them by virtue of its being stuck to each element. Mortars and construction glues are examples of adhesives. The quality of this bond depends on the nature of the elements being joined and the strength of the adhesive. Expansion and contraction are allowed only within the ability of the adhesive to stretch and compress. Adhesives are increasingly used in construction due to the speed and ease with which they can be applied. They are usually quite permanent and allow for no adjustment.



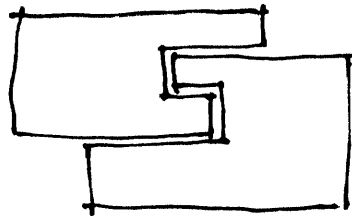
**Connector** Two components are joined with the use of a third element. This can be a dowel, a pin, a peg, or a clamp. The connecting element holds the components together with friction (in the case of a dowel, pin, or peg) or by clamping. The use of connectors requires close tolerances and a tight fit. If a consistently tight joint is needed, the material used for the connector should have similar properties of expansion and contraction to the materials joined, allowing for equal movement. Connectors can usually be easily adjusted and in fact disassembled.







**Fasteners** Screws, bolts, and rivets are fasteners. These are also, as above, a third element in the joining of materials, but they work in a different way. The threads of the screw exert force on the materials, drawing them together and making a tight interface of the two components. Fasteners are fast and easy to install. Tolerances used in their construction are moderate. They allow for very little expansion and contraction; that must be provided by the materials being joined. Fasteners are not normally permanent and do allow for easy adjustment.



**Interlocking** The previous four methods of joining materials require little deformation of the components. The interlocking method is quite different. Here the components are fabricated to fit together, the bond is made by virtue of interlocking with each other. There is no need for a third element. Dovetails, notches, and mortise and tenons are all interlocking details. Tolerances must be quite close to control expansion and contraction, but by virtue of the interlocking, the joint should still function if somewhat loose. Interlocking joints require more labor and can be relatively complicated. They are not normally permanent but allow for little adjustment.

Any given joint or detail can be solved in a number of ways; the solution will utilize one or more of the principles discussed above—but how do we know which solution will be the best? What are the criteria that influence the design?



But the artist, the architect, first senses the effect that he intends to realise and sees the rooms he wants to create in his mind's eye. He senses the effect that he wishes to exert upon the spectator: fear and horror if it is a dungeon, reverence if a church, respect for power of the state if a government palace, piety if a tomb, homeliness if a residence, gaiety if a tavern. These effects are produced by both the material and the form of the space.

Adolph Loos

First we need to know the qualities that are desired in the place which the detail will inhabit. We are concerned with the materials used and with technical issues of structure and closure. There are personal and formal criteria that come into play. Construction has a large role. And we must be aware of the final meaning of the thing.

The remainder of this section will deal with these criteria more specifically.

## Qualities

Architectural design attempts to give spaces certain qualities that are somehow appropriate to the given situation. Details play a large role in defining those qualities. The method by which a wall meets the floor--whether it sits on the floor, or is raised above it, will affect the feeling of the space. We must keep the desired qualities in mind all through the design process, from conceptualization to final details. In this way, the reading of the whole will be consistent with the reading of each part. Within the part--the detail--should be all the information necessary to explain its relationship to the whole.

These qualities are perceived by/through our senses. The feeling of a place is a function of how it looks, sounds, smells, and what its textures are. The visual aspect is probably the most important as it includes all the perceptions of light and dimension that are fundamental in any space.



At this point we should remember that the idea of the world as composed of weightless atoms is striking just because we know the weight of things as well. So, too, we would be unable to appreciate the lightness of language if we could not appreciate language that has some weight to it.

Italo Calvino

The specific qualities I am trying to engender the house with are:

**shelter** the house should clearly be a refuge from the elements.

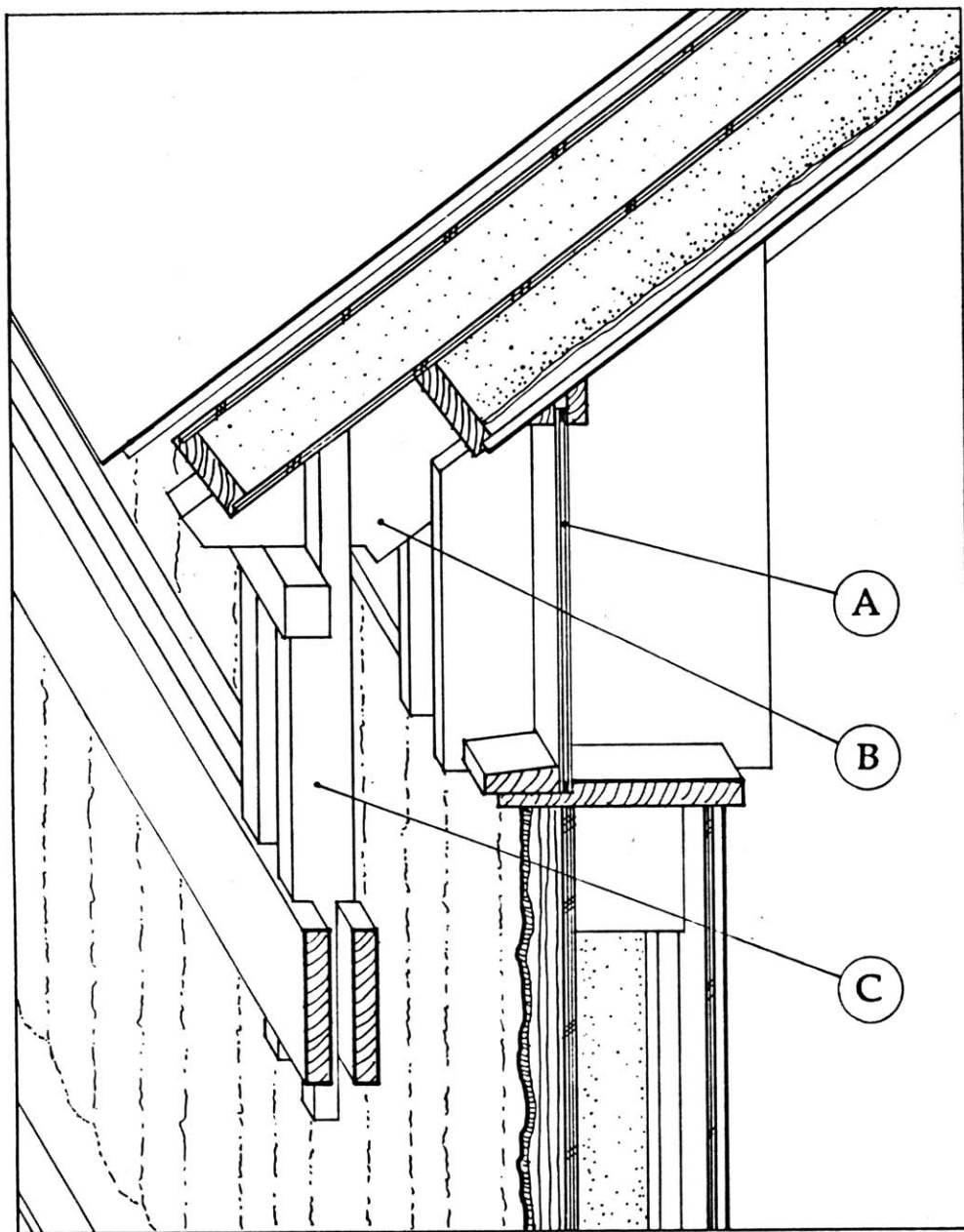
**openness** the building should be open to its surrounding environment and seem to be simply a continuation of it.

**warmth** the spaces should be infused with warmth: in temperature, color, light, feeling.

**lightness** the construction should be of smaller members and assembled to offer strength without bulk or excessive weight.

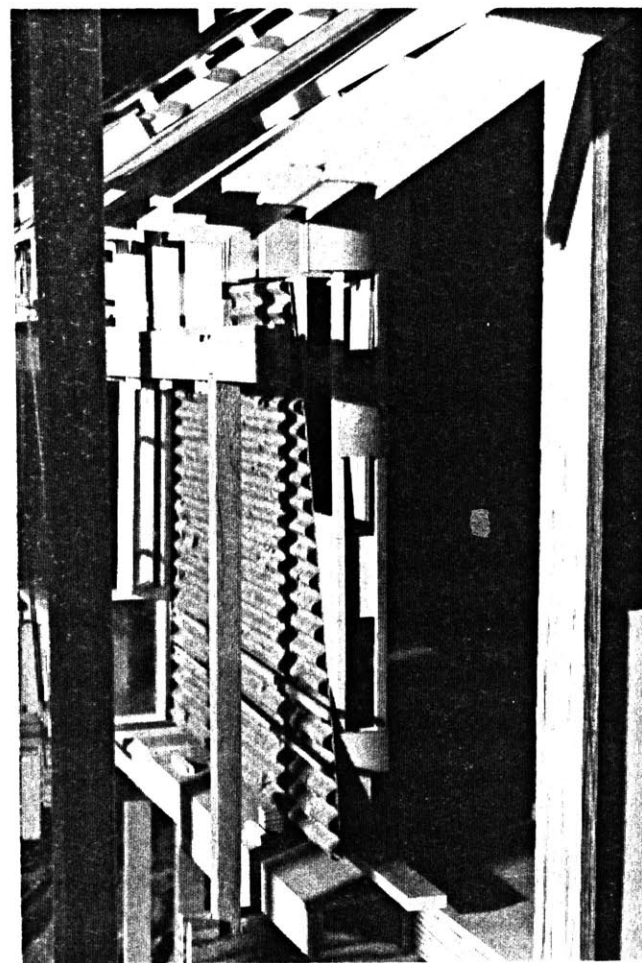
**richness** there should be depth and variety in one's understanding of the diverse places--both within any given space and between spaces.

Hopefully these qualities will add up to a building that can be at one with its surroundings while making a place for inhabitation. And here, the habitation is not generic but very specific: the inhabitation taking place is that of a family creating a home.

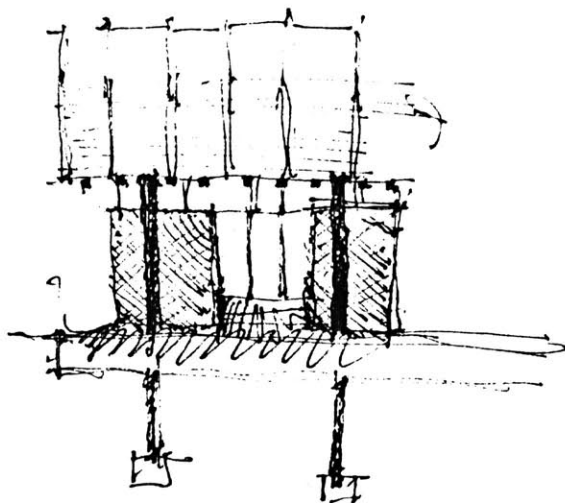


## East Wall/Roof Detail

- A Window, Low E glass double paned
- B Roof Rafter
- C Frame supporting roof







Sometimes qualities can be overall--throughout the whole building; other times they want to be specific to a particular place within the project. Perhaps the quality may need to be only within the detail itself. But whatever the parameters are, we must keep them in mind through the whole design process. In this way we can be sure that the outcome will have the feeling that we desire.

These qualitative aspects have influenced the design of even the smallest elements. Following are two examples:

*East Wall* The wall on the east side faces the best view and the strong morning sun. The desired quality here is openness. The wall then is removed from both the ceiling and the floor, allowing each to continue on past it. The eye is drawn out, into the landscape. The roof is not directly connected to the frame either, allowing space and light between all the elements. the space behind the wall then is very light, without being fragile; open, without being completely transparent.

*West Wall* Here the desired qualities are almost the opposite. Shelter and warmth are more important. The west wall encloses the living area which is more a retreat to be used in the evening and at night. The wall is firmly connected to the floor and the ceiling. The ceiling rafters sit directly on the frame. While still using a similar vocabulary, we want to create a different quality than that of the east side.



Every material possesses its own language of forms, and none may lay claim for itself to the forms of another material. For forms have been constituted out of the applicability and the methods of production of materials. They have come into being with and through materials. No material permits an encroachment into its own circle of forms. Whoever dares to make such an encroachment notwithstanding this is branded by the world a counterfeiter. Art, however, has nothing to do with counterfeiting or lying. Her paths are full of thorns, but they are pure.

Adolph Loos

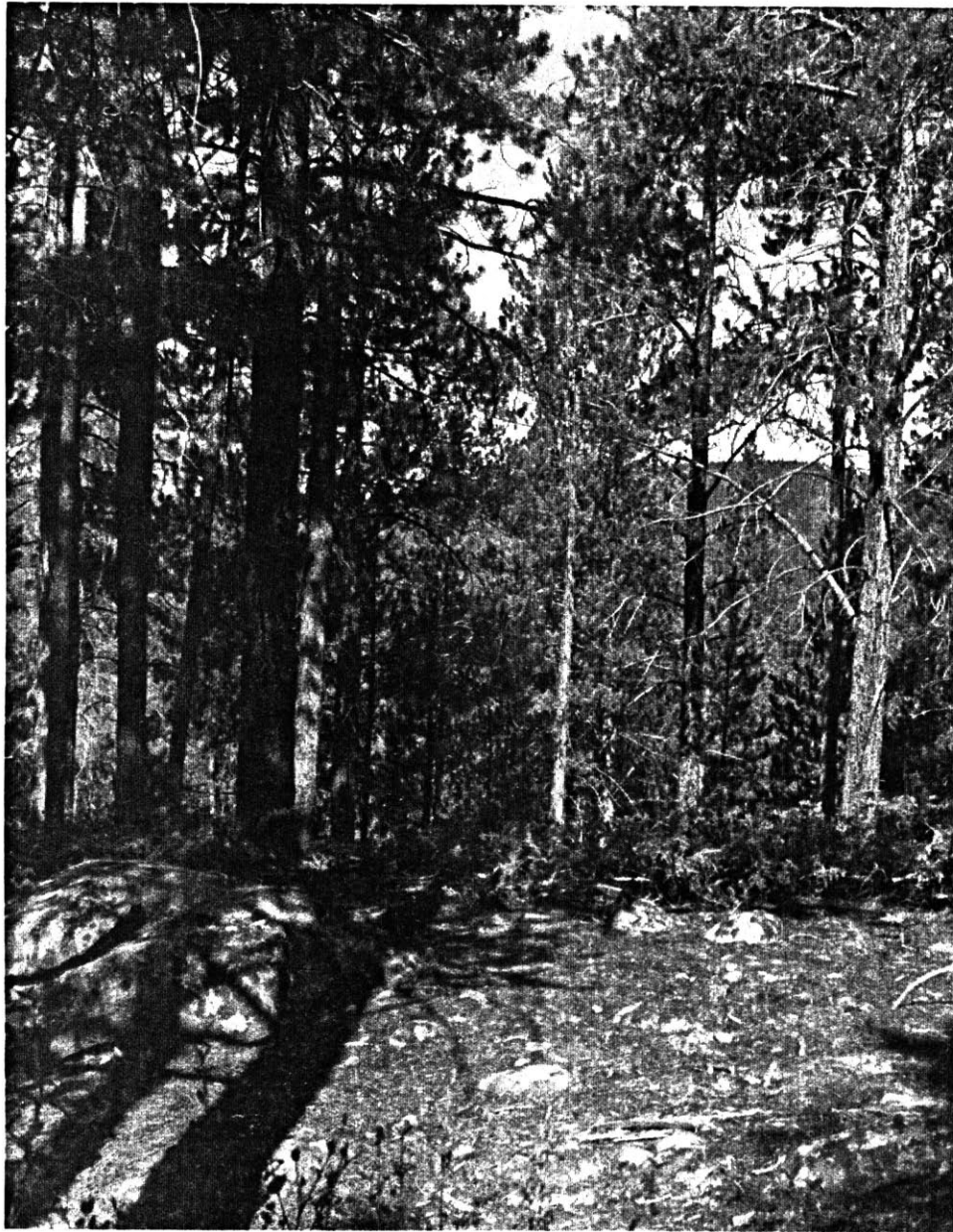
## Materials

The importance of materials cannot be overstated. Architecture is in fact the art of correctly choosing and deftly manipulating those materials. The best architecture will always contain a skillful use of material. Witness Hertzberger's use of concrete block; Carlo Scarpa's understanding of stone and concrete; the wood constructions of Greene and Greene--all contain a clear understanding of what the materials are capable of. All further our comprehension of the material itself, as well as the spaces it makes.

Louis Kahn suggested we ask a material what it wants to be. Indeed we must be cognizant of the inner nature of the material and use it in a way that is true to that nature. The nature of any material has two aspects that must be addressed: the qualitative and the technical.

*Qualitative:* these are the characteristics that will help us choose the material in the first place. We choose wood if we want a warm, natural effect; stone if it needs to be solid and hard; steel if it is to be sleek and strong. For instance, we would not use concrete as wall material if we wanted a cozy, warm room. We might admire the concrete houses of Tadao Ando but we would never call them cozy.

*Technical:* a material is also chosen for its technical properties. These are issues having to do with tension, compression, bending, etc. Concrete is strong in compression, weak in tension. Steel cable is great in tension but has no compression strength. Wood is good in tension, compression and bending but its strength is limited--if the stresses are too high, steel may have to be used instead. The technical aspects of a material will be important when it is decided where and how a material is to



*"Well, Al, the sixties was peace. The seventies was sex. The eighties was money. Maybe the nineties will be lumber."*

In the past carpenters also paid a great deal of attention to the grain in the wood and before cutting a joint would turn the pieces or alter the angle of the miter to compensate for the effects of future shrinkage. Then the carpenter would consider the placement and shape of his mortise and tenon and the effect they would have on the joint and only then would he mark and cut his joint, to create a firm joint that took full advantage of the character of his lumber and would in time shrink tightly together rather than apart.

Kiyosi Seike



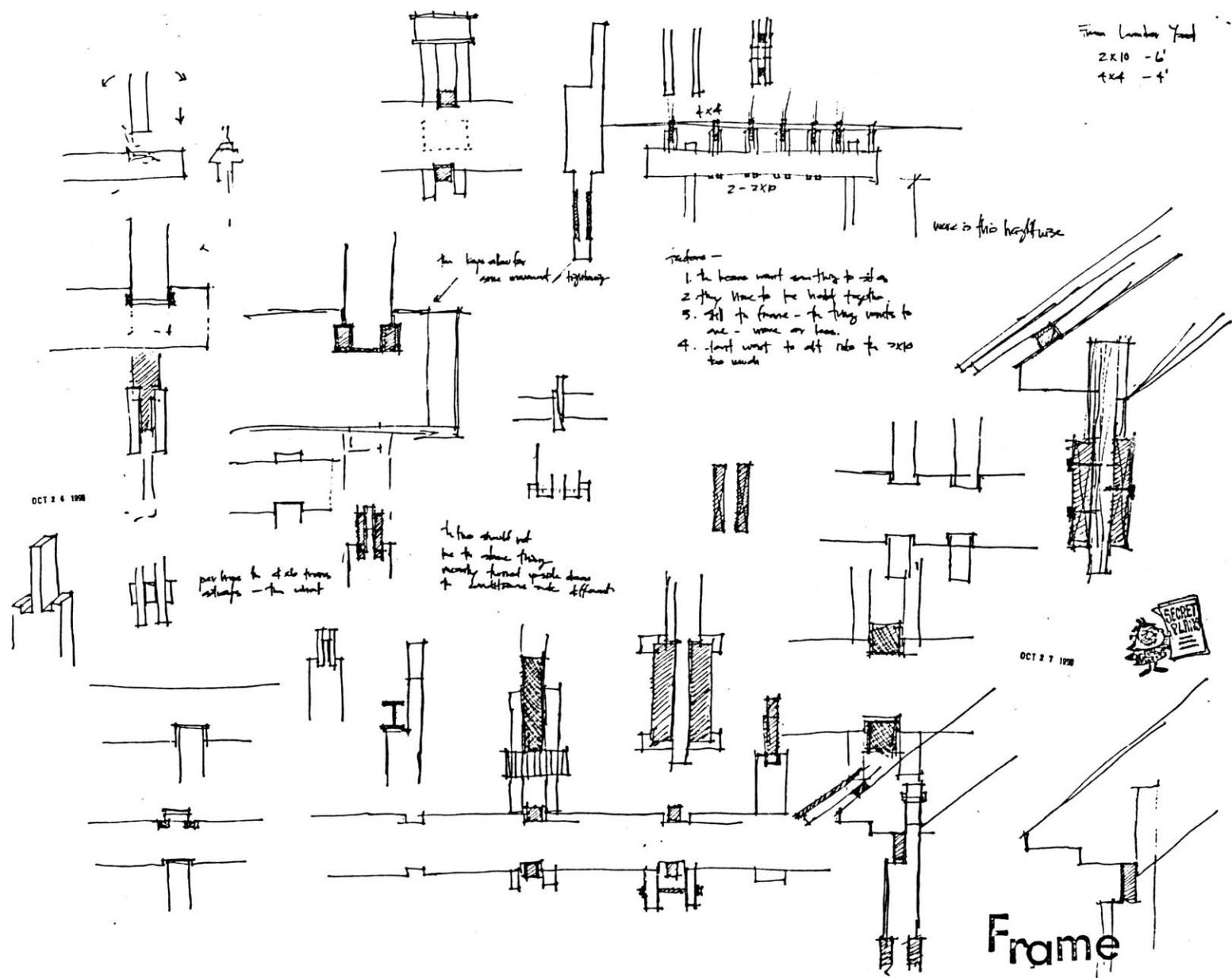
be used, particularly with regard to detail. Just think how different the details are in a concrete block building and in a traditional wooden house in Japan.

Also to be considered are availability, cost, and ease of construction. Often a budget constraint will limit choices of materials, or the time allotted will not allow the details to have the desired complexity if the material is too difficult to manipulate.

The main material to be used in this house in Colorado is wood. Wood is chosen for its inexpensiveness, ease of manipulation, and also its particular qualities. If this house is to be one with its surroundings, its materials must be of those surroundings. The very trees that populate the site now will become, virtually, trees supporting the roof; their protective bark will become the protective siding of the walls. The details of the building talk about the transformation of the material from tree to finely crafted joint.

Wood has a unique ability to record the passage of time. The patina that hand-hewn logs, made into posts, exhibit over time can contain many memories and stories in the cuts, scratches, and dents. The gradually darkening color will let the wood tell its age. In a home these qualities are important. Our home is the place where the family resides and thus helps us to define ourselves. The ability of the home to record changes and events in the lives of its inhabitants helps us understand who we are by knowing where we came from. This characteristic of wood also allows the family to make the home their own. The ease with which one can affect wood makes the building adaptable to the various needs and idiosyncrasies of the users;



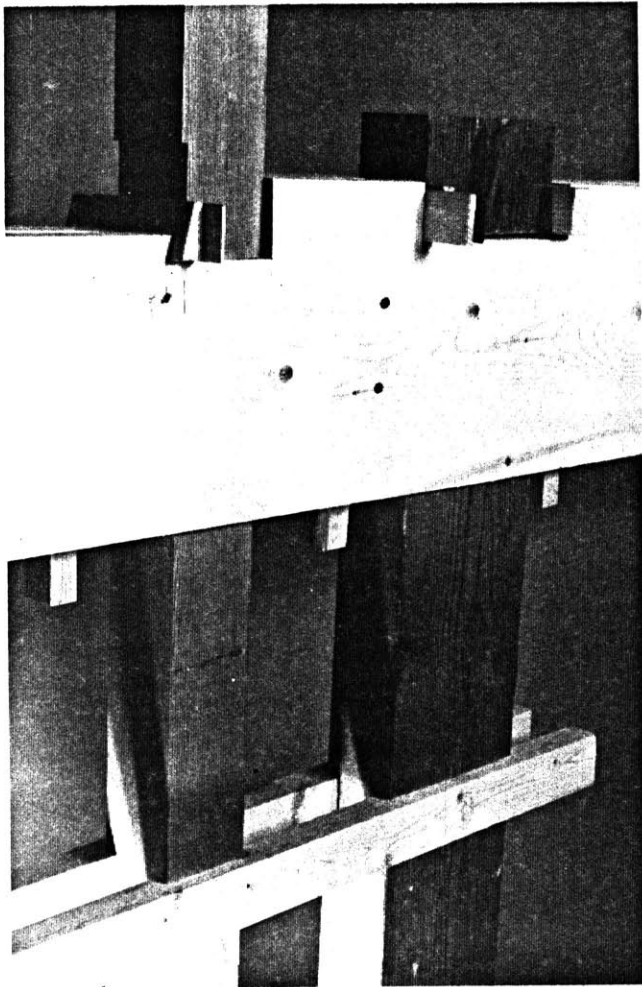


just as the tree from which the wood came had its own idiosyncrasies and oddities that add to the character of the wood.

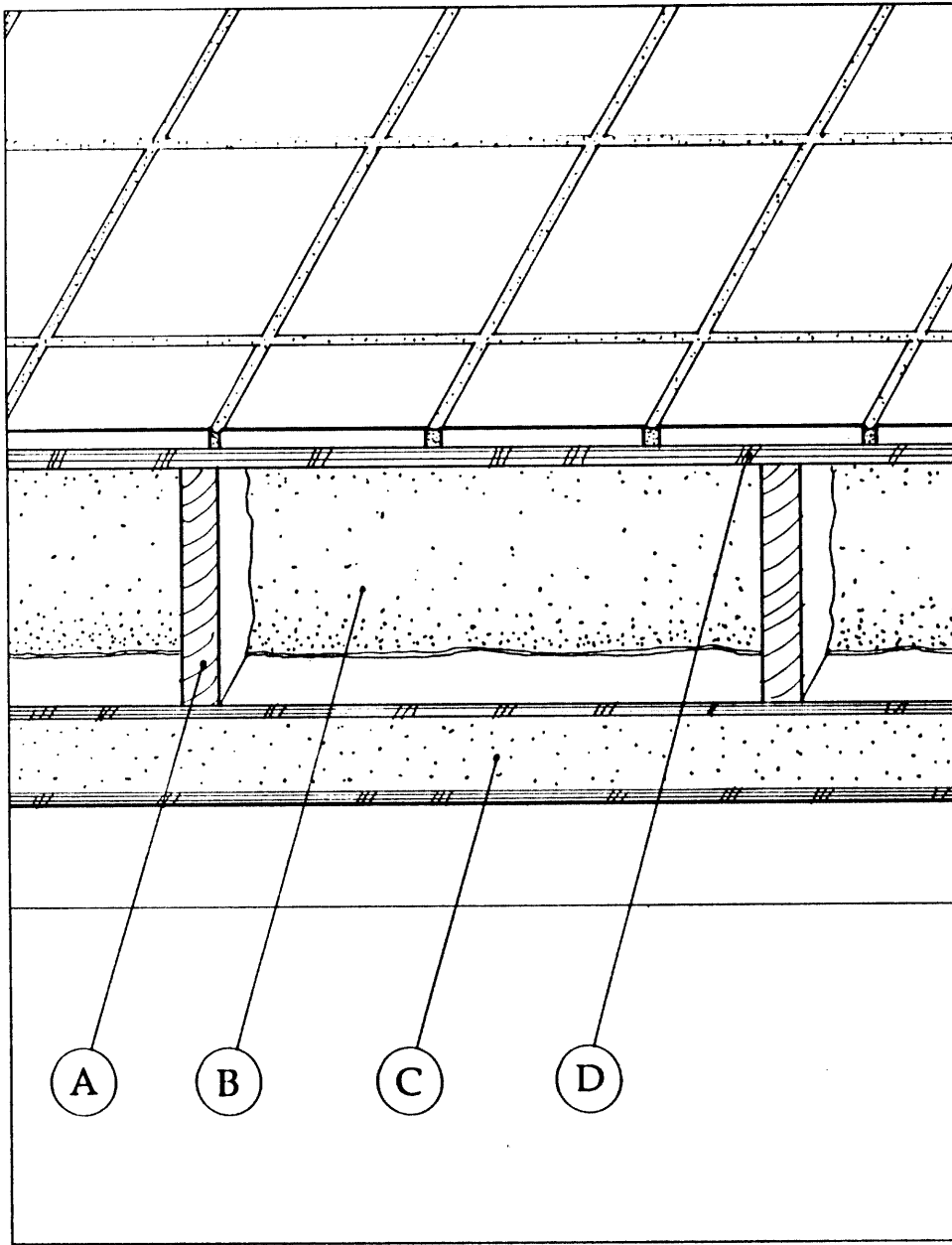
Wood is used because it is warm, in color as well as to the touch. But likely the finest aspect of wood is that it is a living thing. We can see and feel the very life of the wood in its grain, it tells us its age and where its branches were. This gives it a power that no other material can match.

Detailing with wood must take into account all the aspects discussed above, but they are provided for by the material simply being there. The technical aspects of wood will play a larger role in the detail stage. Wood is an anisotropic material; its properties have different values depending on the axis of measurement. As strength in a joint is considered, we are concerned about the amount of material and the direction of grain as it relates to the direction of the force. We are also concerned with expansion and contraction of the wood, which will take place to varying degrees depending on the direction of the grain.

The joinery in the frame of the house contains much notching and interlocking of pieces. Care must be taken to leave enough wood at the end of any member so that the notch can be completely three-sided. There must be enough bearing surface while minimizing the amount of wood removed, which weakens the joint. The constant movement of the wood as it expands and contracts with moisture changes calls for the ability to adjust the tightness of the joint. In these examples, wedges are used. These technical characteristics of wood are largely what determines the sizes and components of these details.







## Platform Detail

- A Floor Joist—2"x 10," spaced at 2' o.c.
- B Fiberglass Batt Insulation
- C Insulation Panel—polystyrene foam sandwiched between 1/4" plywood
- D Finished Floor—ceramic tile on 3/4" plywood

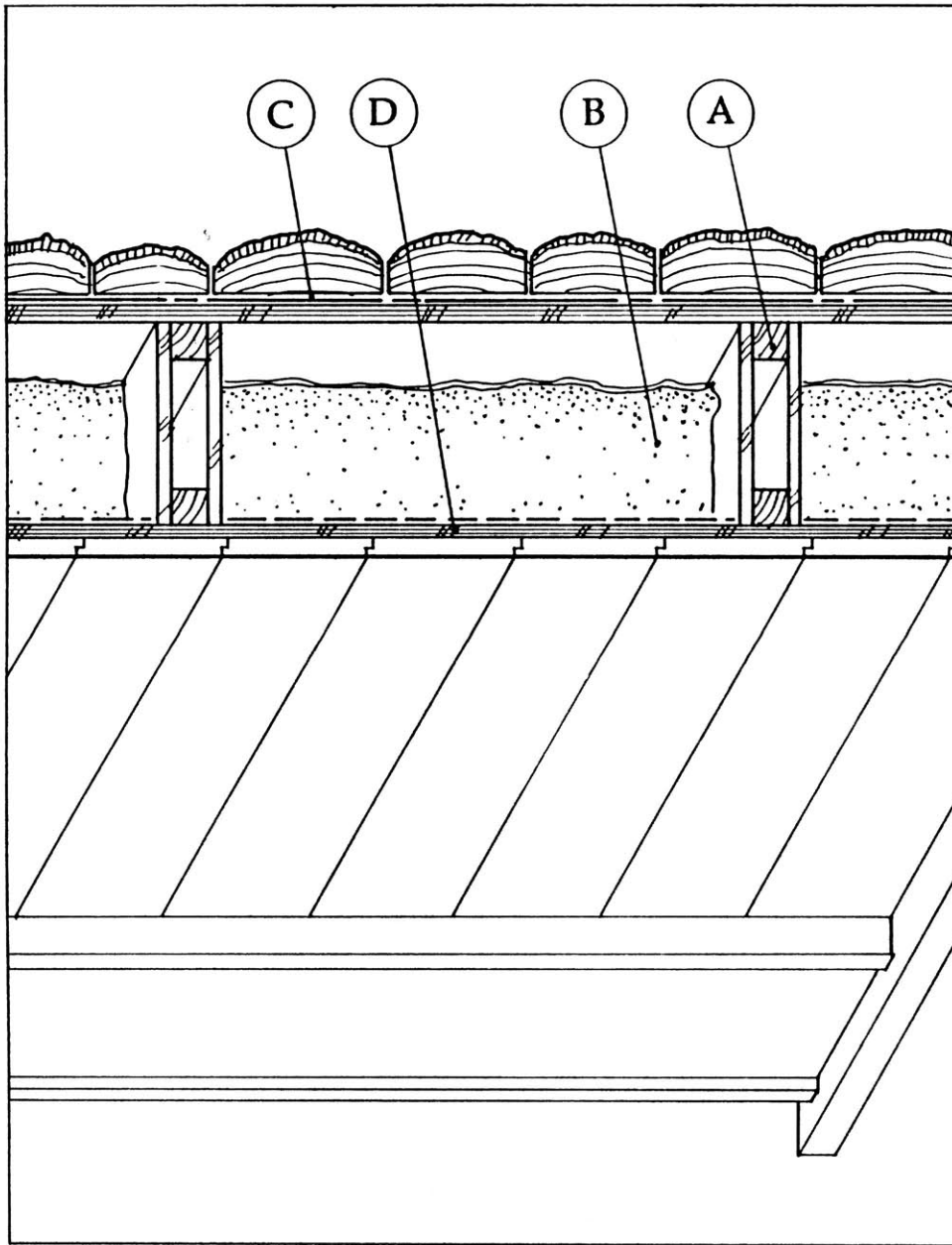
Detailing is no more deterministic than design. It is simply a design process informed by technology.

Edward R. Ford

## Technical Issues

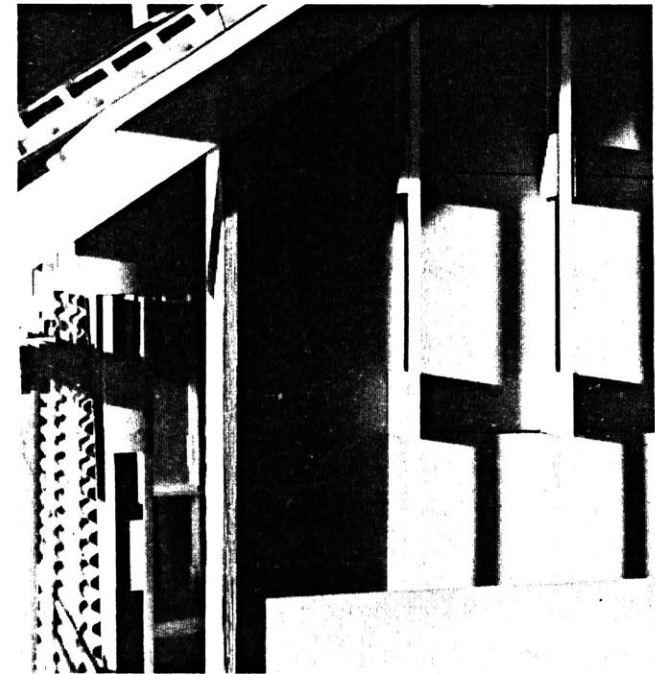
The most important function of any architectural detail is to solve some physical problem. If a joint fails, it can lead to failure of the entire building. (More evidence of the integral nature of part/whole). The performance of a detail depends on its material, its form, and its location in the building. The materials and formation are integrated in a manner that will suit the location and the required performance. The forces acting on a joint are a function of the location of that detail within the building. The location of the building in the world will also determine the forces that come to act on any given joint. A building in Arkansas has very different detail requirements than one in Florida. The following is a list of forces that joints may have to resist in the mountains of Colorado:

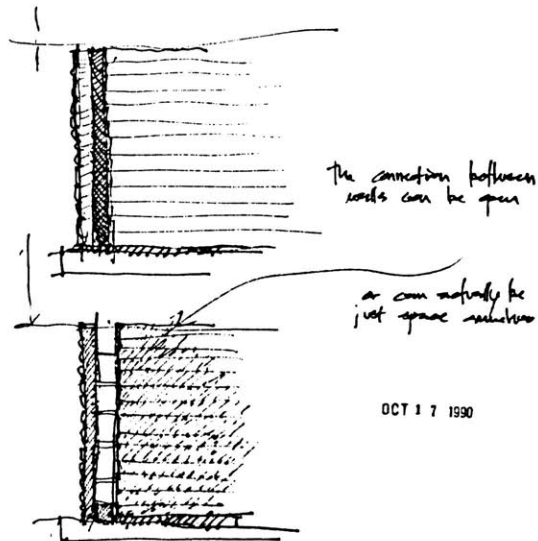
- Control passage of insects and vermin
- Control passage of plants, leaves, roots, seeds and pollen
- Control passage of heat, sound, light, and radiation
- Control passage of air and other gases including water vapor
- Control passage of water, snow, and ice
- Control condensation
- Control generation of sound



## Wall Detail

- A Truss Stud—constructed of 2"x 2"s with 1/2" plywood connectors, placed at 2' o.c.
- B Fiberglass Batt Insulation
- C Wall Exterior—slab-wood siding on building paper on 5/8" plywood
- D Wall Interior—wood paneling on 1/2" plywood on Vapor Barrier



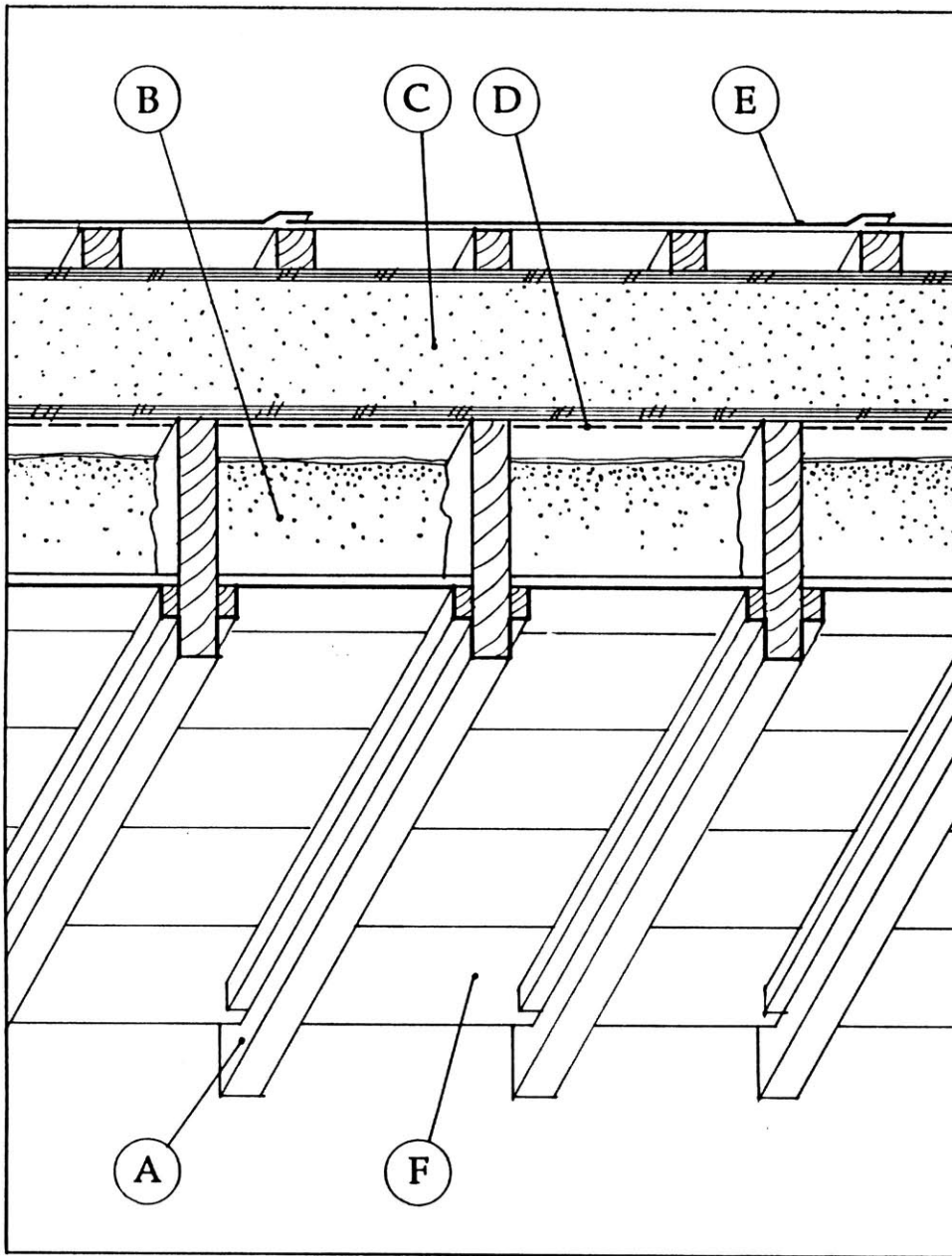


The detail must resist stress in one or more directions due to:

- Compression, tension, bending, shear and torsion
- Vibrations (or any type of stress which may induce fatigue)
- Impact and abrasion
- Expansion and contraction due to temperature of moisture changes
- Creep
- Avoid generation of toxic gases and fumes in case of fire
- Accommodate variations in the sizes of the joint at assembly due to deviations in the sizes and positions of the joined components
- Resist differential deformation at joined components
- Permit operation of movable components
- Resist actions of extremes of temperatures

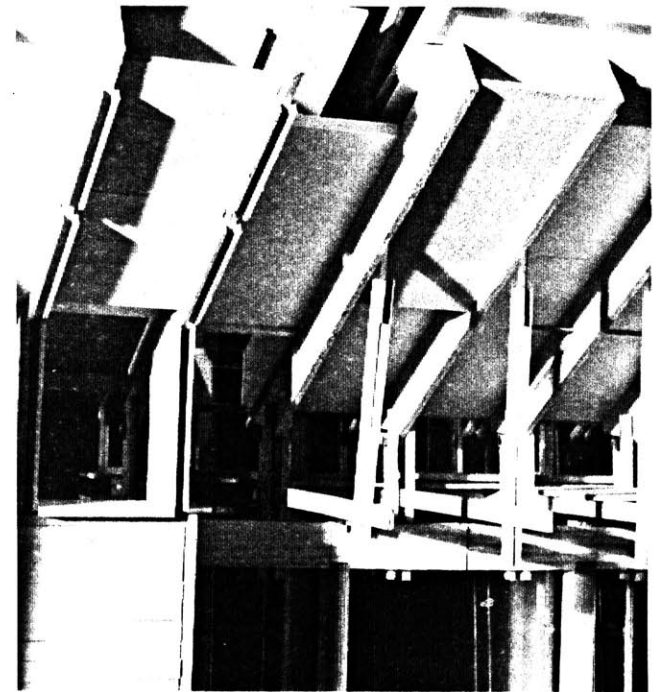
(Taken from International Standard, ISO 3447)

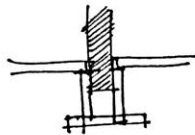
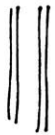
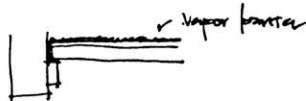
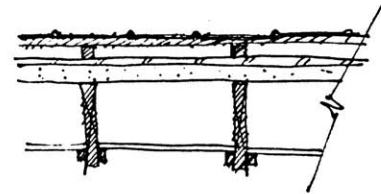
These factors come to bear when considering both the larger elements: walls, roofs, and frame; as well as between those elements. For example, a wall must be designed to keep the water and air out and must provide insulation to the cold. The connection of that wall to the floor or foundation must also control those factors.



## Roof Detail

- A Roof Rafters--2"x 10," spaced at 12" o.c.
- B Fiberglass Batt Insulation
- C Vapor Barrier
- D Insulation Panel--polystyrene foam sandwiched between 1/4" plywood
- E Roof--enamel painted metal on 2"x 2" stringers
- F Finished Ceiling--wood paneling on ledger strips



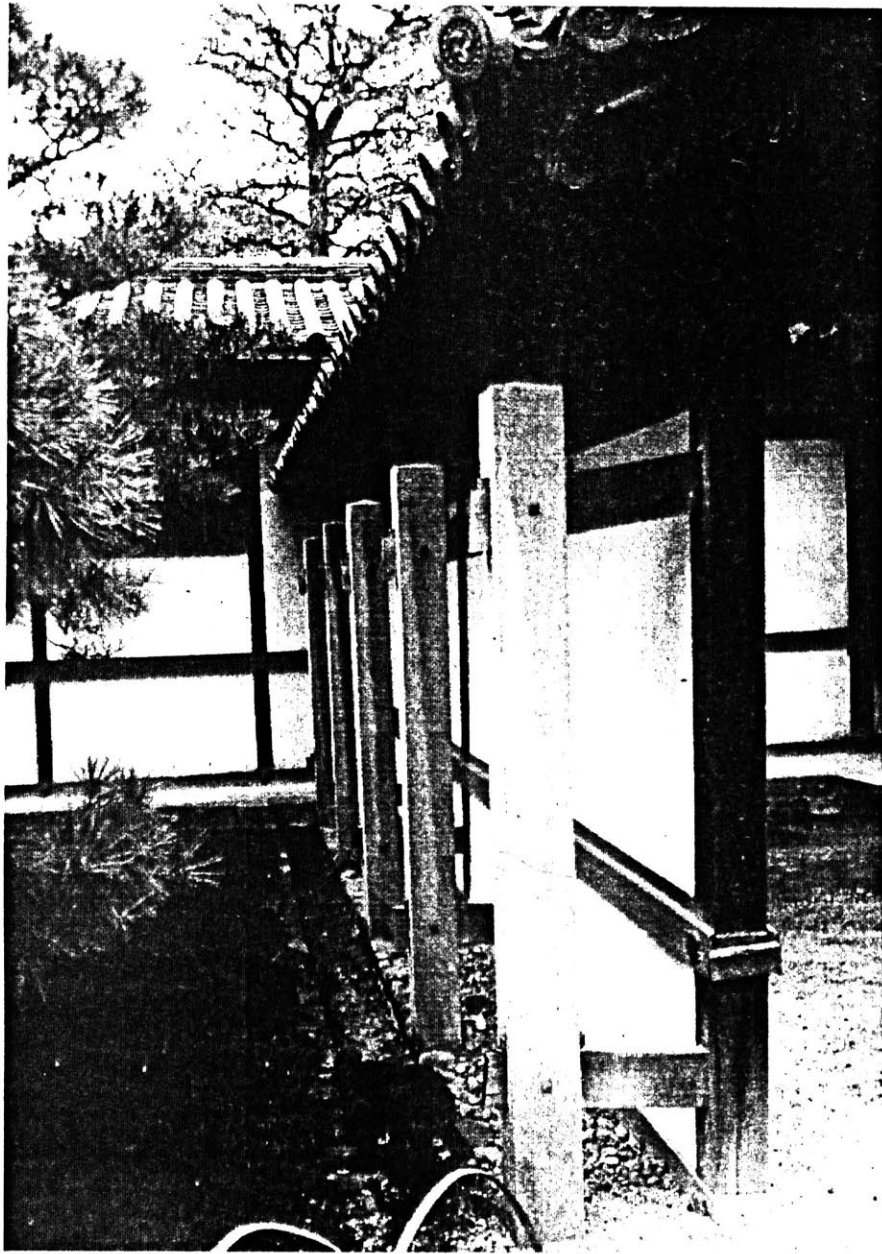


All architecture proceeds from structure and the first condition at which it should aim is to make the outward form accord with that structure.

Viollet-le-Duc

Often these considerations are looked at as harsh constraints to the form-minded designer. I would argue the opposite. In fact, the technical requirements help give a detail its form. If we allow these aspects to affect the form, the outcome will be a detail that will be honest about its function and will in fact be able to tell of its function. The designer may choose to exaggerate this or that aspect in order to achieve a desired effect; but it is important that the form be of its technical function, and not be a decision based on form alone.

Technical considerations of details have been involved in every joint that I have designed in this house. Some of them are almost second nature, such as keeping water out of the walls and roofs. Others are more technical and harder to track down: variations in expansion properties of different materials; resistance to deterioration due to sunlight. But I found that whichever technical aspects are considered, they have almost always had form implications. Of course it's not always the case that these aspects will jive with formal desires.



When you reach the end of a book, you should still find it possible to remember the beginning. Otherwise the novel loses its shape; it's "architectural clarity" is clouded.

Milan Kundera

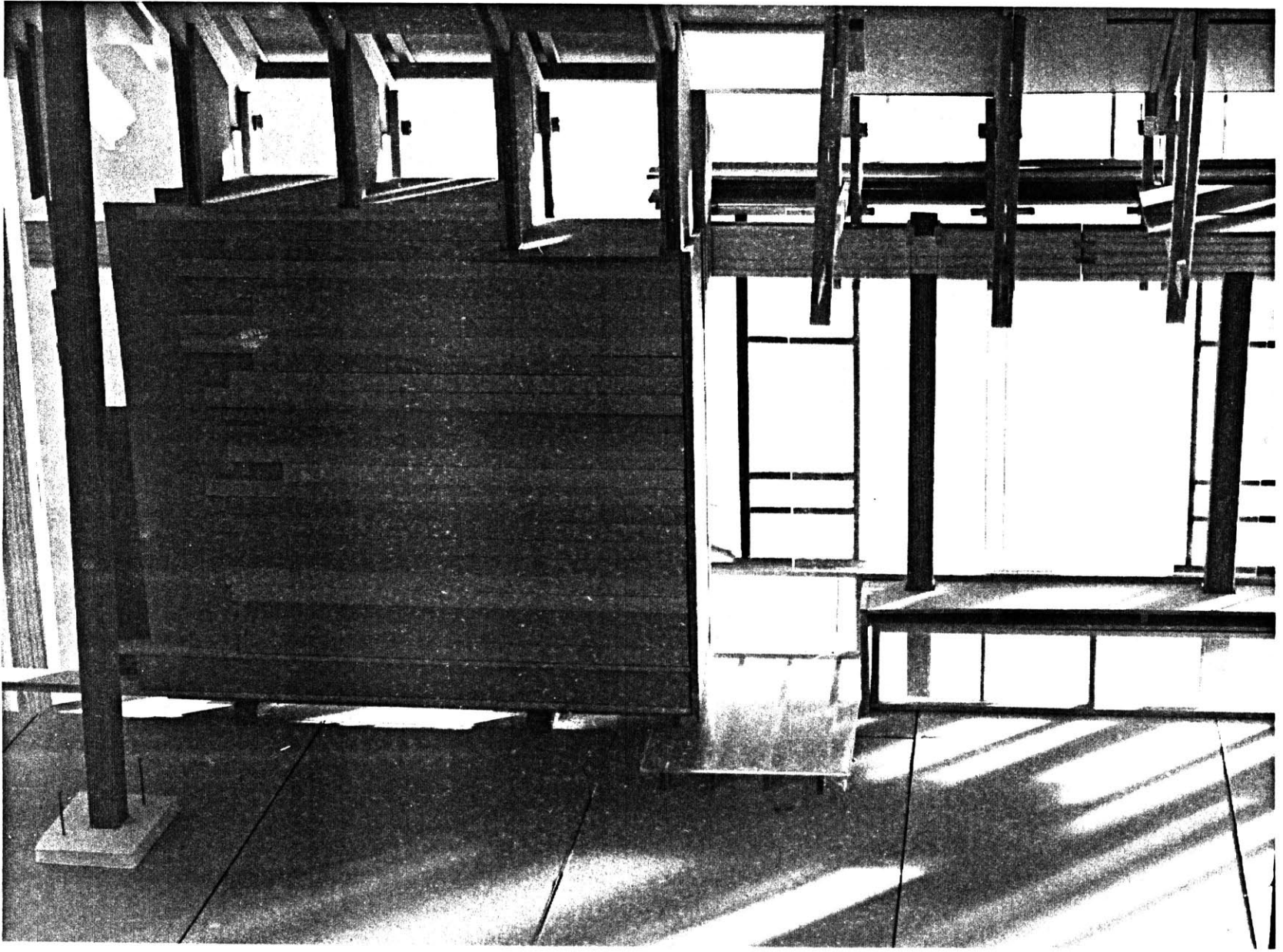


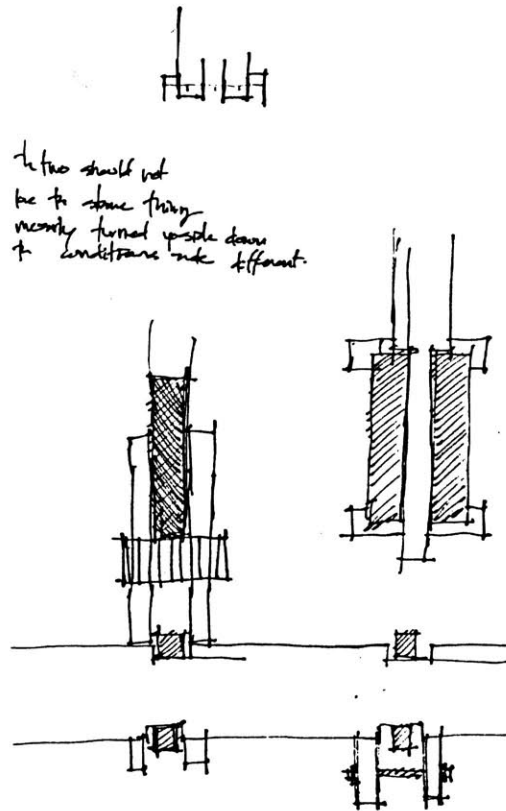
## Formal Issues

All designers have their own vocabulary of form, their own personal concerns and ideas about design that inform their work. These concerns should also show up in the design of details. My task here is to somehow attempt to explain my own concerns and how they affect the design of the details.

**Understandability** In order for us to experience a building completely, we must be able to understand it. Information regarding its structure and construction must be made accessible. My main reason for rejecting conventional American wood frame home construction is its inability to talk about what it is. Every joint is covered up and hidden--dry walling being the most extreme example. It's very strange that we cannot tell a bearing wall from a mere partition, because they are constructed the same. In the detail lies the ability to explain function not only of that detail itself, but the construction and purpose of the larger elements as well.

**Articulation** The need for understanding leads to articulation. Articulation involves giving each function and form its own voice with which to make itself known. The joining of materials should allow for each piece to retain its own identity as it functions within the larger context. When designing, therefore, we need to keep all the functions of the joint and all the forces acting upon it in mind. The result should be a joint which explains itself by way of each individual aspect acting within.



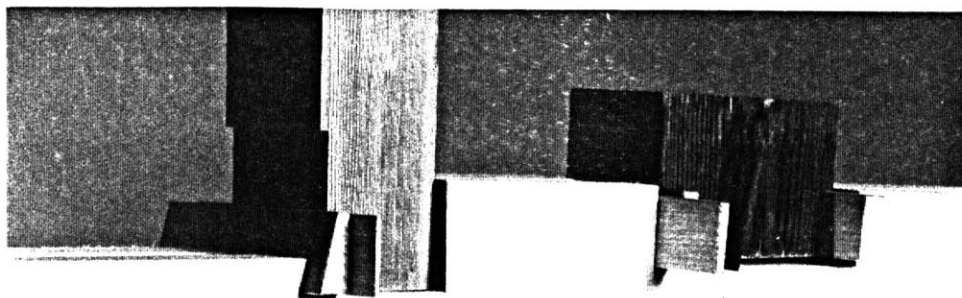


**Richness** There should be variety and diversity of experience in a building. There must be more than a simple surface understanding of any detail; deeper exploration should enrich the visual reading of the architecture.

**Simplicity** This may appear to conflict with richness but I think I mean something different. Details should be solved with ease and grace; their construction ought not be forced. This does not mean that the problem should be solved in the simplest manner, but that complexity and effort should not be added unless they aid in the understanding of the detail.

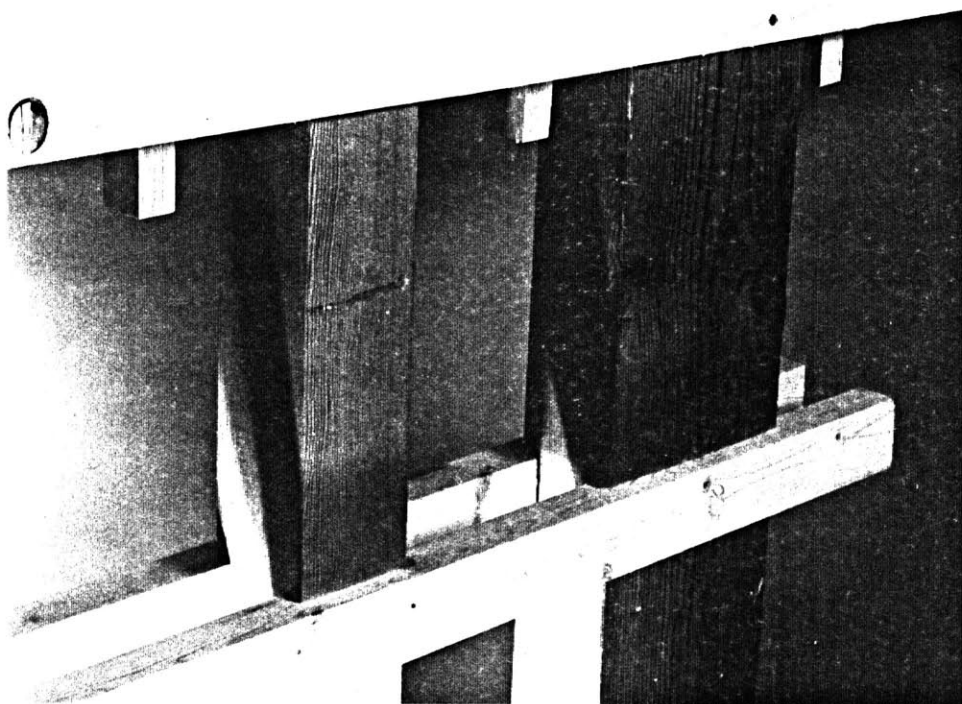
**Light** Openings to the light must be placed within the plan with regard to the inhabitation of the spaces. Light is used to inform the use of a space. Light can also be used to inform the details. The light must be considered and used at every scale in detail. The more light and space that can be introduced into a joint, the clearer the articulation of each element, and thus the clearer the reading of the joint.

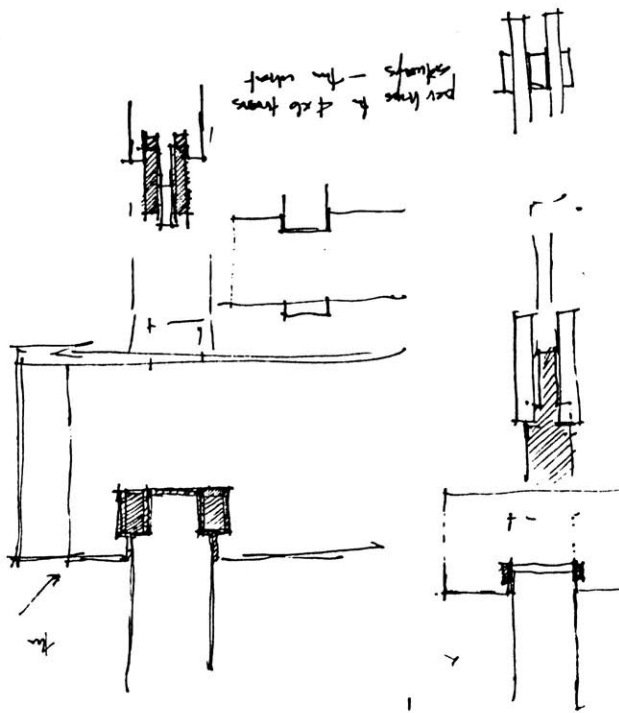
These personal attitudes lead to a certain vocabulary of form that can be seen in the photographs on these pages. While I do end up using all the five ways of joining materials that I discussed earlier, I tend to stay away from adhesion and fasteners. While I think they are useful in such cases as the joining of plywood or other sheet material to lumber, I do not use them often as they tend to destroy our ability to comprehend the forces acting on the joint. They are too much a universal tool.



### Frame Joint

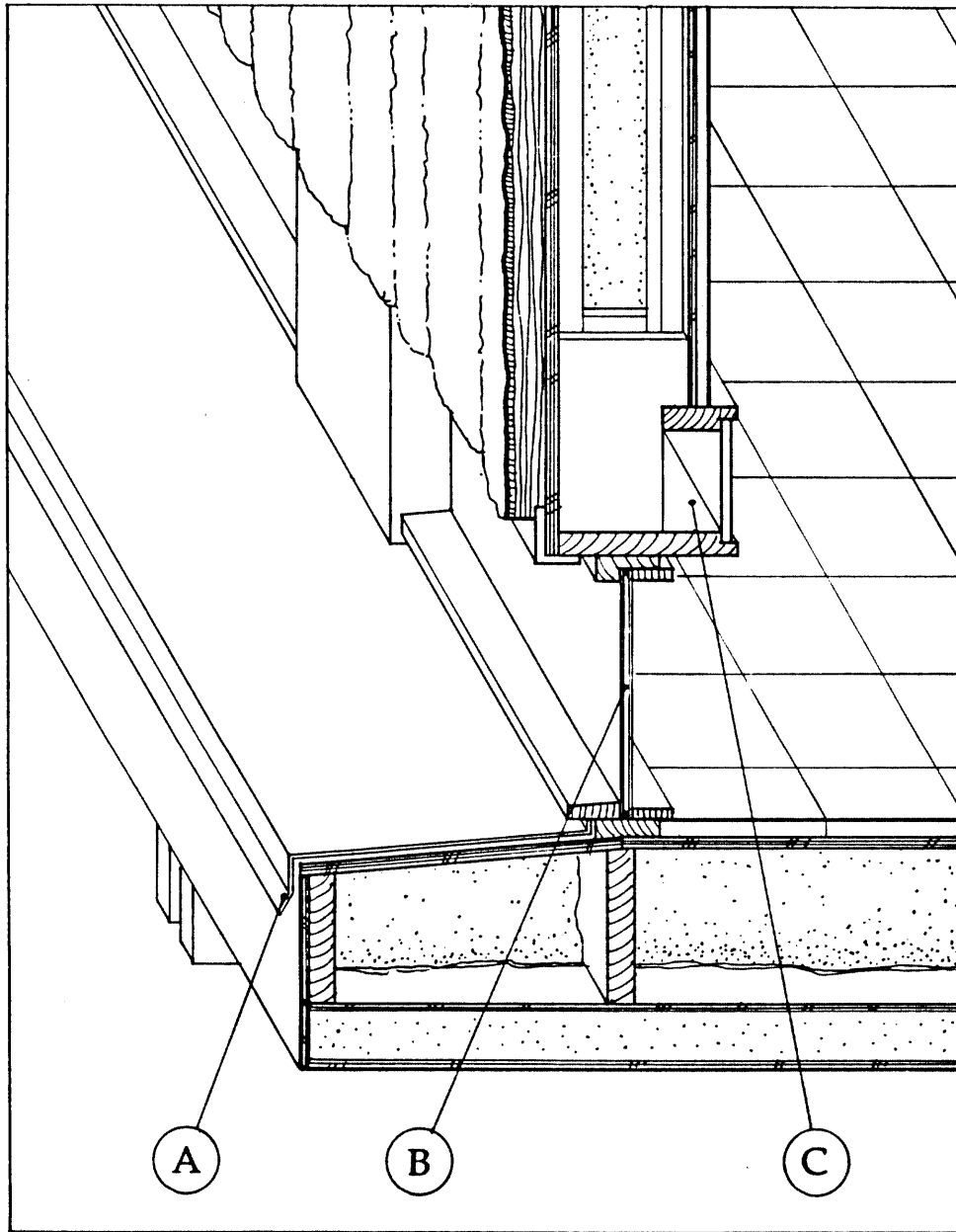
2" x 12" Beams connecting to 4" x 6" post from the ground and 4" x 4" post to the roof. The joint is located at the front (east) side of the house.





When two or more elements join and want to more or less act as one, I will likely interlock them in some way. (See the frame details as an example). The fact that each component must be altered to accept the other not only makes the joint strong, but due to the reciprocal relationship, it makes each component more a part of the other.

The other type of joint often used is one in which the elements want to stay separate from each other. They each want to strongly maintain their integrity by being altered little. In this situation I will use some sort of connector. There the connector is what does all the work. Often it will have to be a rather special fabrication and of a different material (in fact it should be). The use of connectors allows for maximum articulation, light, and openness.



## East Wall/Platform Detail

- A Metal Flashing glass
- B Window--low E glass, double paned
- C Electrical Channel

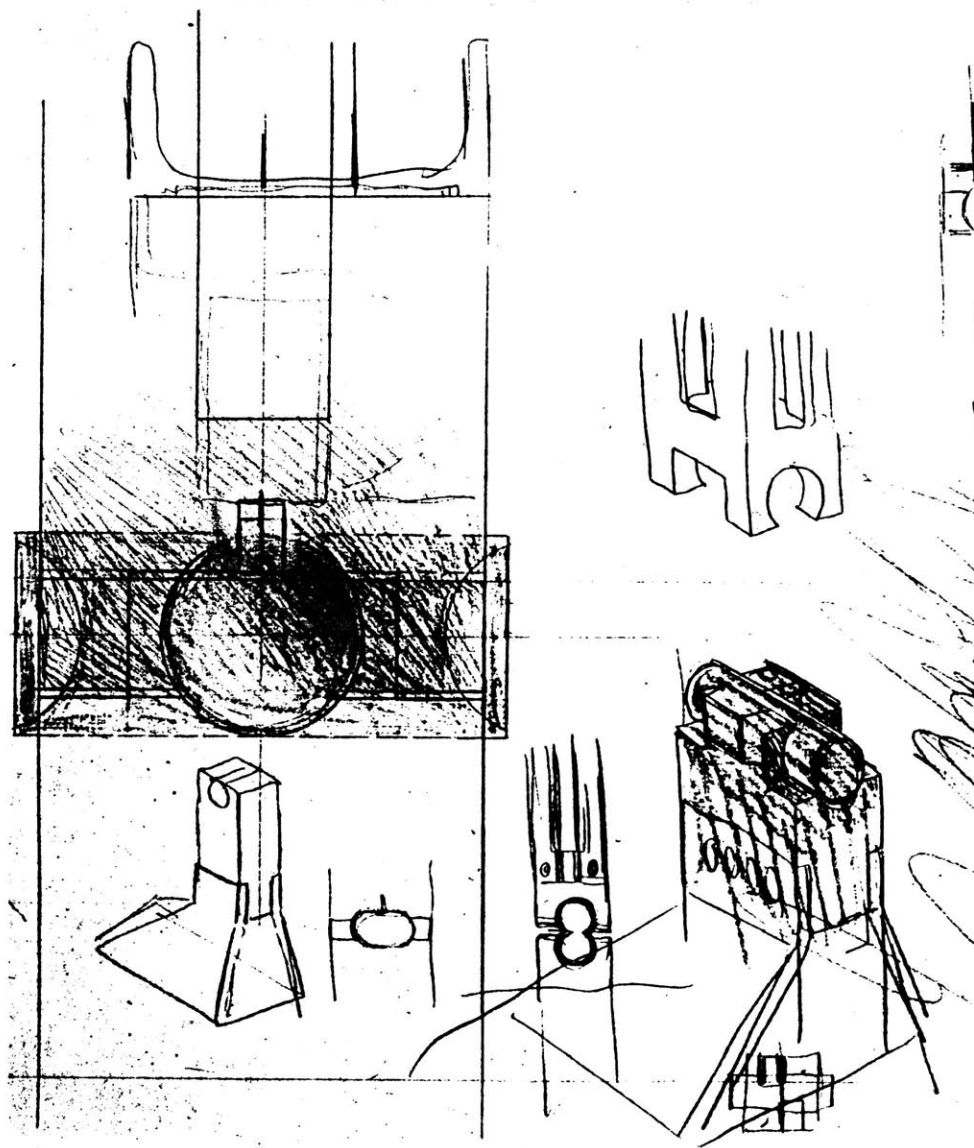
## Construction

The design of architectural details is inexorably bound to the chosen method of construction. A designer needs to know and understand the construction system fully--what opportunities it provides and what the limitations are. The construction is the architecture after all, and if the details are to be of the building, if they are to be at home, they must be true first to the construction system. The details must therefore obey the rules of the system, in order to be at ease within it.

The relationship between the designer and the craftsman is key. Both parties need to know the abilities and limitations of the other. The craftsman needs to understand the goals of the designer in order to make the details properly. The designer must be able to trust the craftsman to construct the details in a manner true to his wishes. This relationship is so important because the process of design and the process of making must be able to inform each other.

When people built their own houses, the making and the architecture were the same thing. The design was done while the construction happened. The design was not a representation of the imagined thing, rather, it was the thing itself. Today there are typically many more stages involved--the person wanting the house is almost completely removed from the process of its making. To me the ideal situation is that the architect be the builder, and in that way be directly involved in





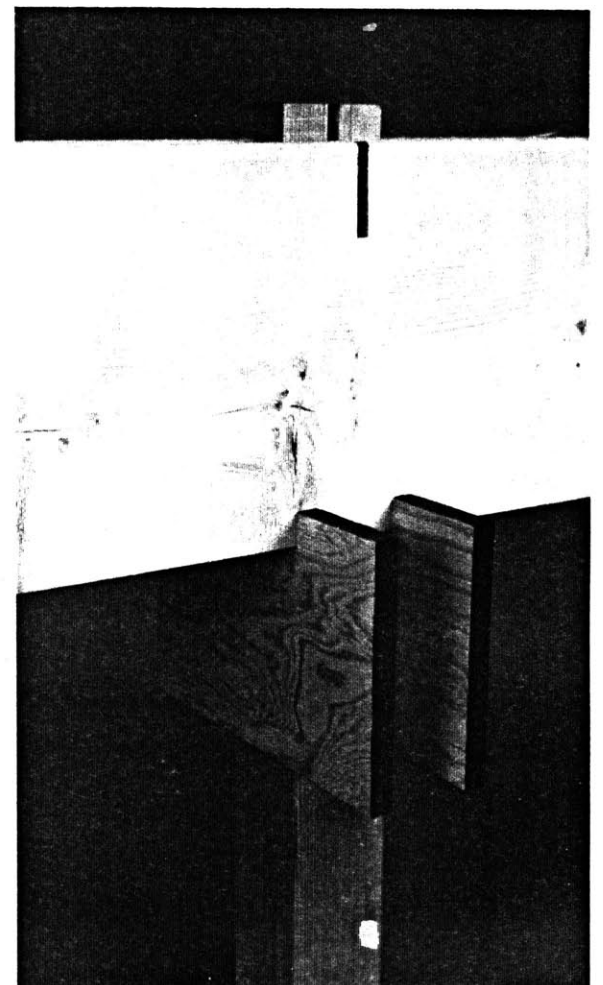
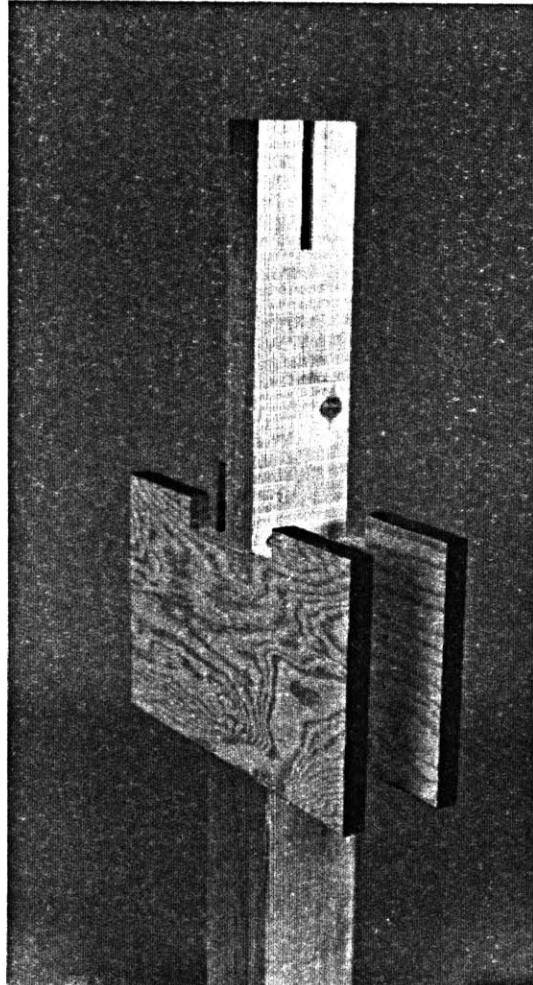
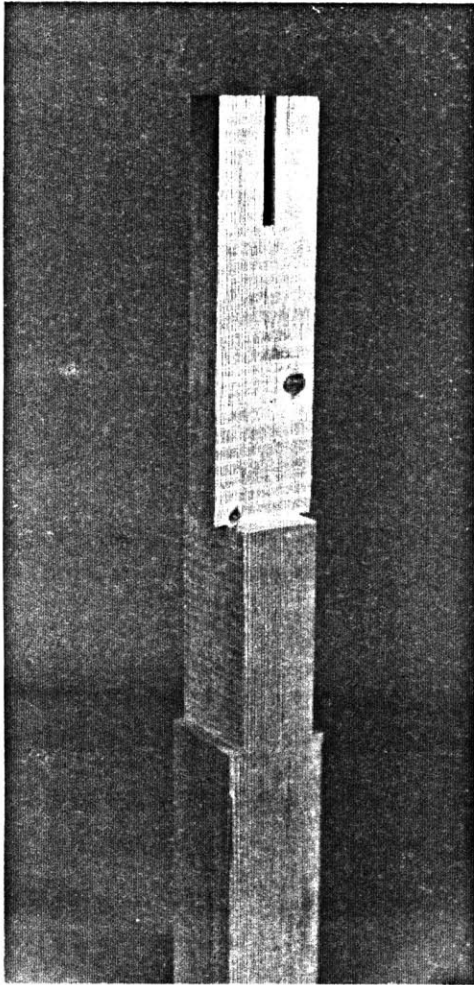
Only when one individual forms the concept of the various projects and also determines the character of every detail in the sum total, even to the size and shape of the pieces of glass in the windows, the arrangement and profile of the most insignificant of the architectural members will that unity be secured, which is the soul of the individual work of art.

Frank Lloyd Wright

the making. If, however, this is not possible, the communication between the builder, the craftsman, and the architect must be constant and fruitful. An example is the relationship between Carlo Scarpa and the craftsmen of Venice. In their book on Scarpa's details, Alberti and Bagnoli describe this relationship:

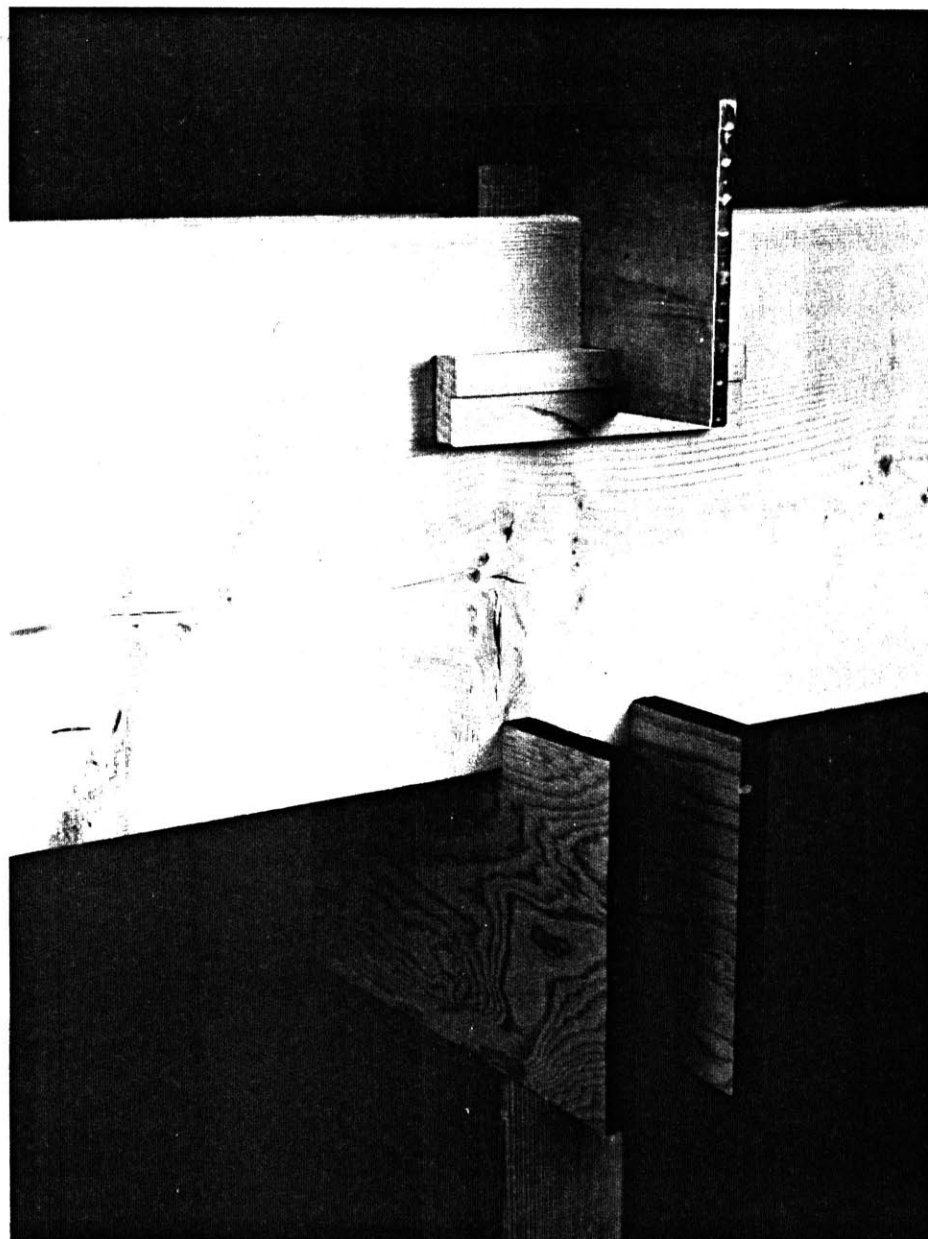
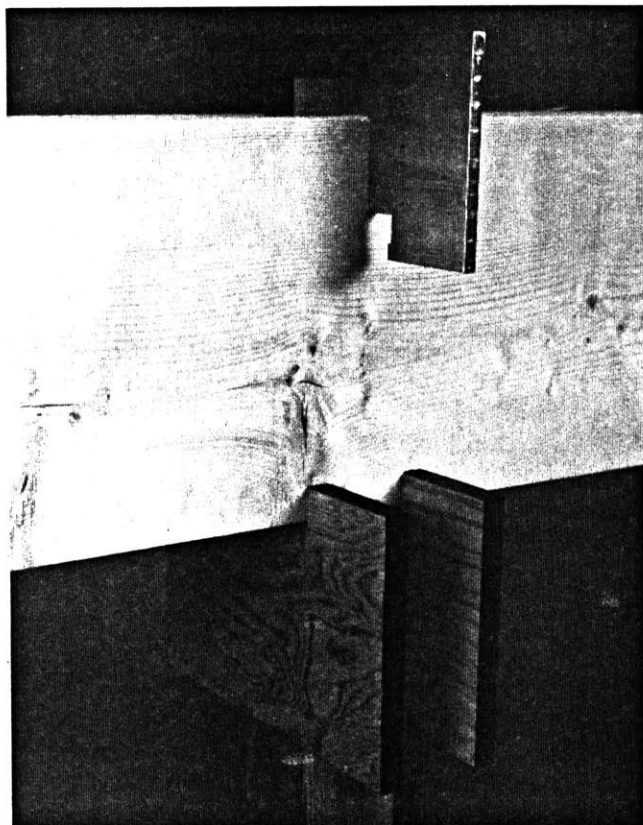
*The elementary rule for having a job well done, he (Scarpa) said, was to place oneself in the hands of the right man, and he confirmed this belief throughout his activity by working, almost without exception, with the same craftsmen. He knew their specific professional capacities, his relationships with them were marked by esteem, and even friendship. He employed them whenever he was working, whether in the Venetian region or in Sicily, in Switzerland, or even Montreal....he knew by now that he could rely on their abilities. They in turn showed an intuitive understanding of his requirements without need of long explanations.*

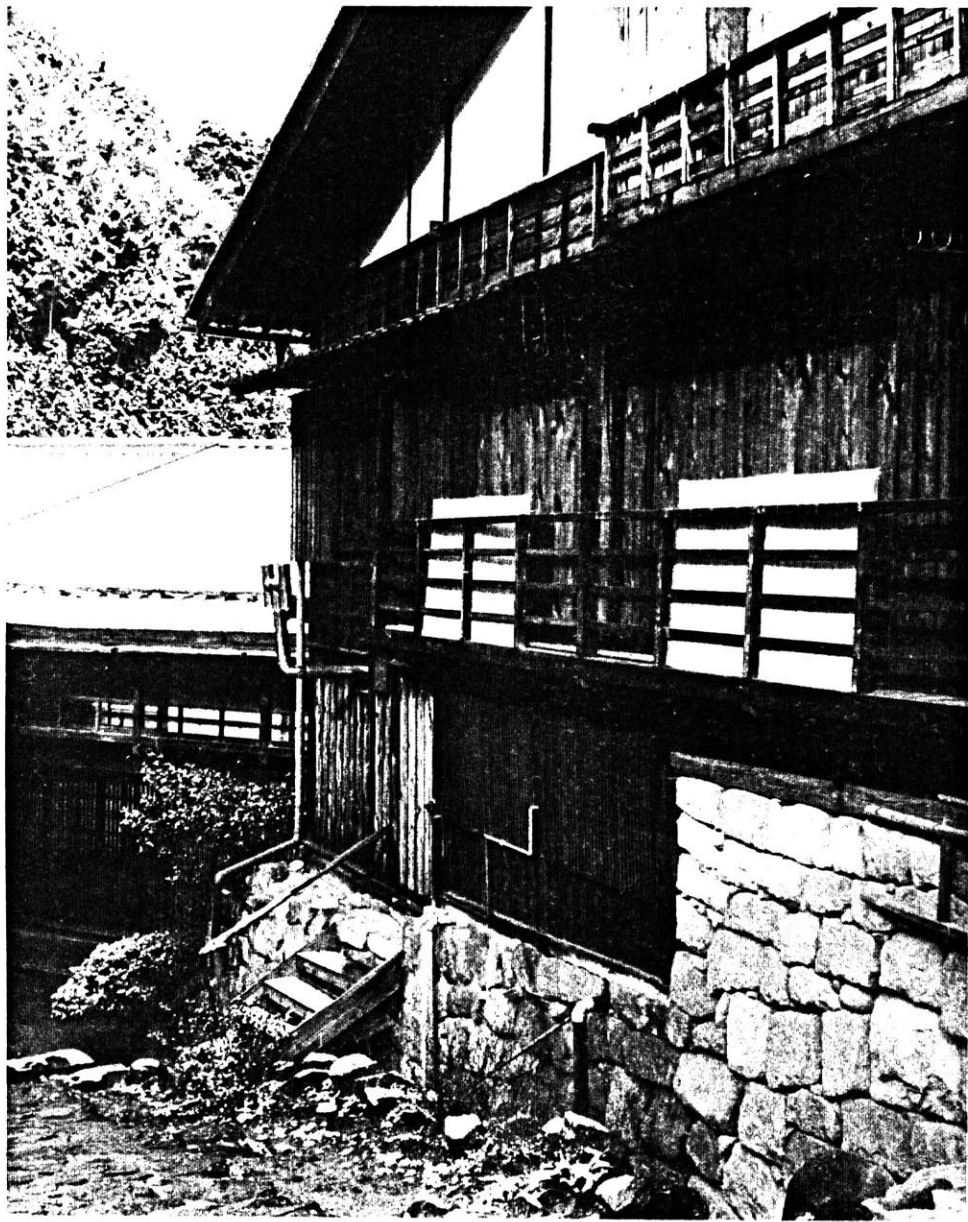
The act of making greatly affects the design of architectural details. We can draw on paper, to scale, the design of a joint, but until we actually touch the material with our hands we cannot know how it will react to our wishes. To better understand this I built some full size details out of real materials. This helps in two ways: first, conditions such as size, support, direction, and material are made clear; thus we are able to consider them directly. Nothing can be left out, one cannot be lazy. Second, the materials, and the tools used to manipulate and assemble them, tell of the opportunities and constraints acting on the detail. When asking the wood what it wants to be, one must have the wood there in his hands; in that way its answer will be richer and truer than ever imagined.



## Frame Joint

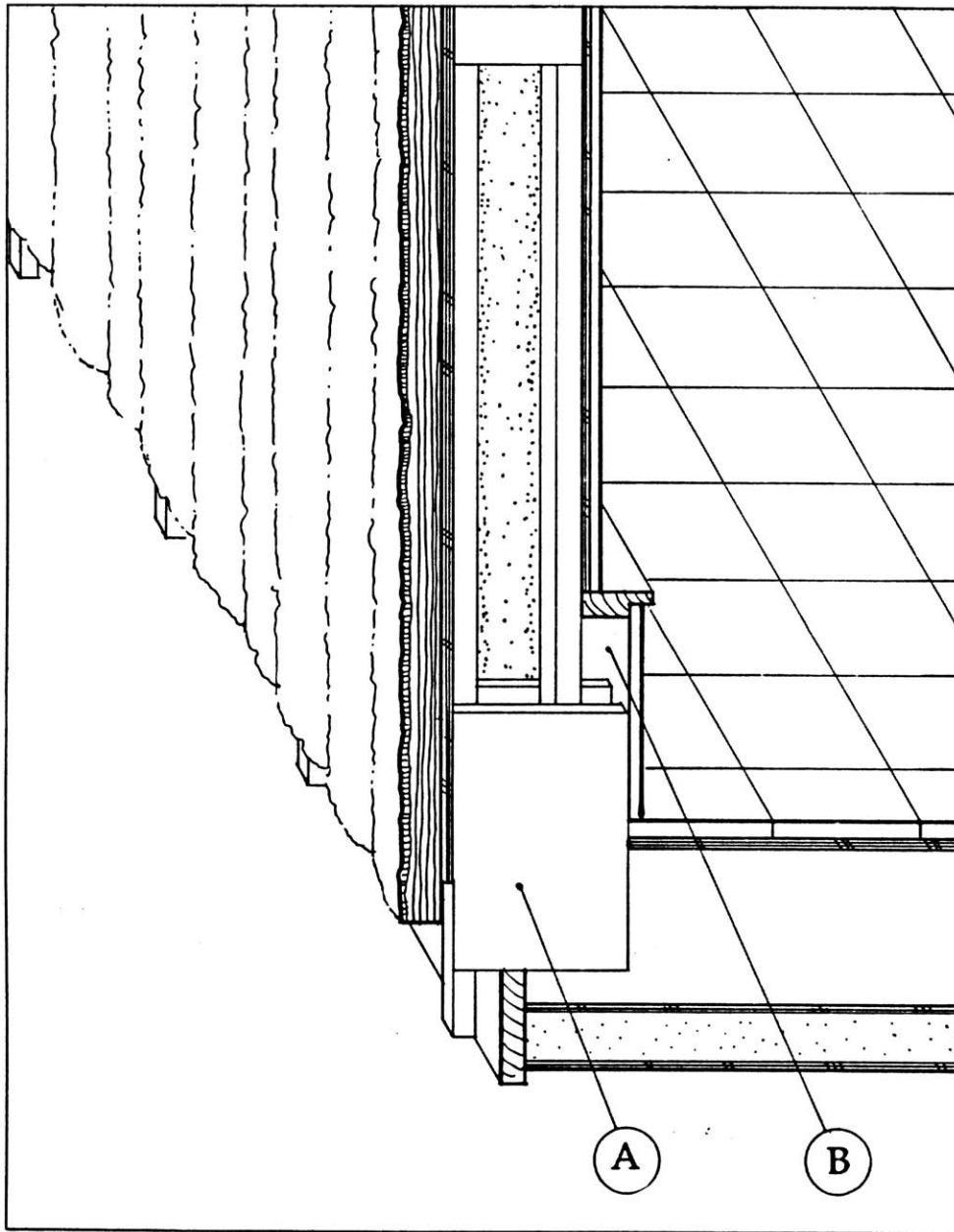
2" x 10" beams connecting to 4" x 4" post.





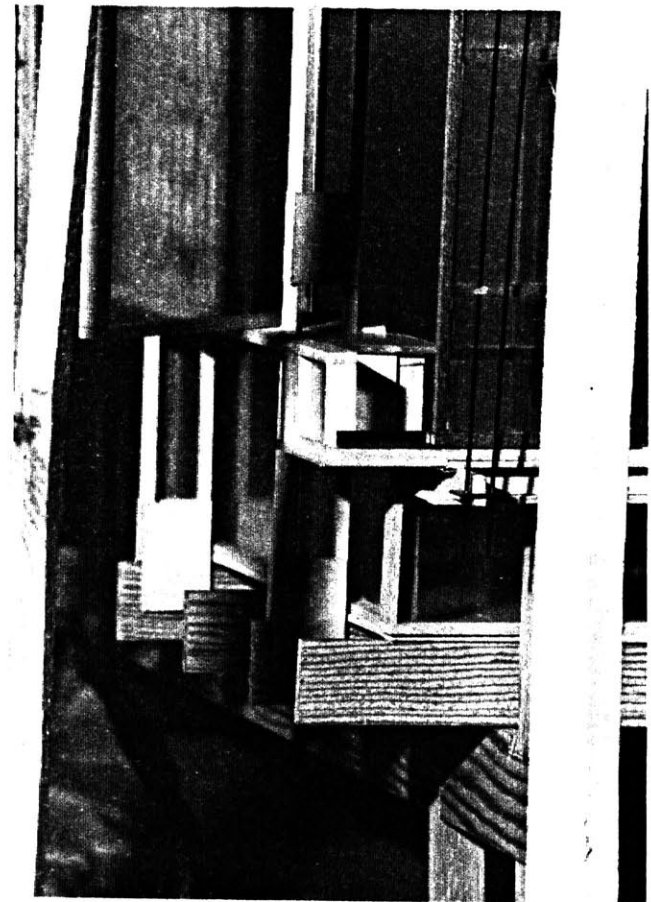
**Monolithic vs. Cladding Systems** Most architecture today is made up of several layers of materials. The American homebuilding industry is a good example. The levels of materials are varied--construction grade vs. finish grade--as are the levels of craftsmanship. The advantage of this system is that a very sloppy frame can be put up quite quickly and cheaply, and then subsequently covered up and finished with high quality craftsmanship and materials. But the fault of this way of building is that the construction is never shown, it is deemed unattractive, and must be covered up--eventually it is simply ignored. If we are to use a system that is structure plus cladding we must let each aspect be known. We must celebrate the cladding and allow for a reading of the structure as well.

A monolithic building system allows for great simplicity and honesty in construction. All the construction is simply what it is--there is no layering. The adobe architecture of the American Southwest is a good example of a monolithic system. The walls are solid adobe, the same inside as out. The roofs are constructed of vigas and latias, logs and branches that are not even cut to square. A high level of craftsmanship was not required. The whole system is exposed, it is honest, and it is good architecture. Rudolf Schindler also sought a monolithic construction, but his designs required a uniformly high level of craftsmanship and in fact, the materials were highly manipulated.



## North Wall/Platform Detail

- A Plywood Truss stud connector joins to floor joists
- B Electrical Channel

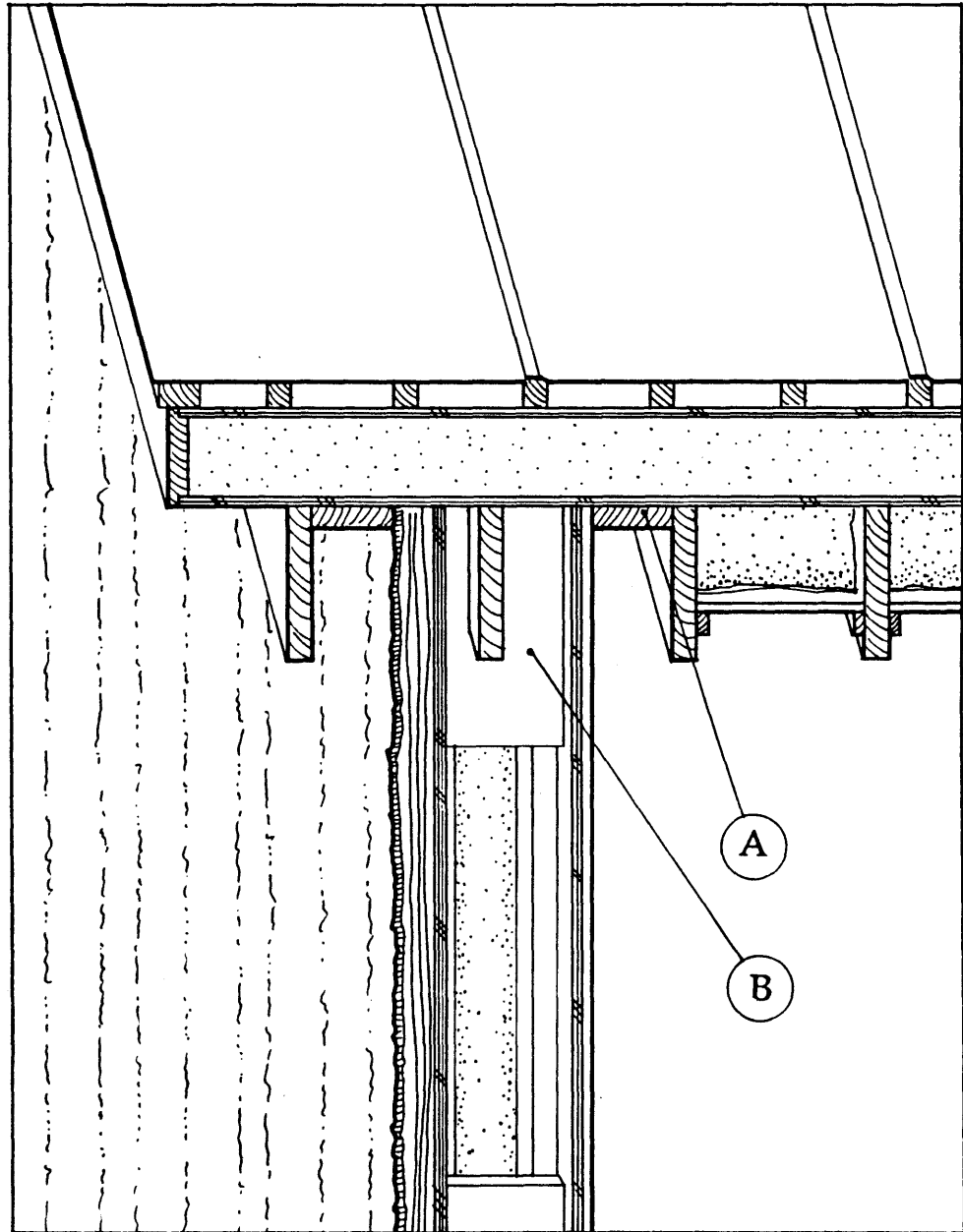




## North Wall/Roof Detail

A Blocking—helps hold wall in place

B Plywood Truss stud connector joins wall to roof rafter

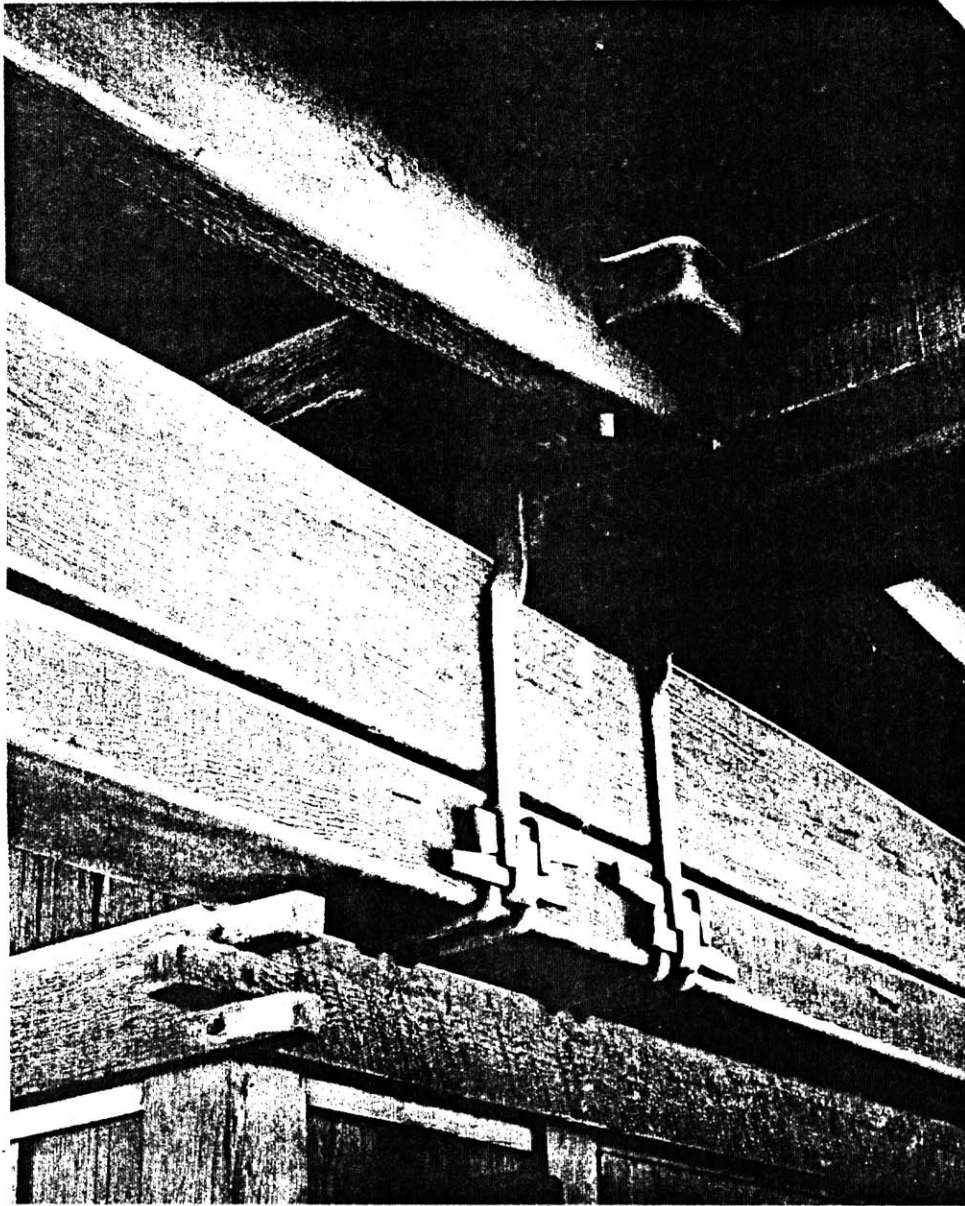




Frank Lloyd Wright, whose earlier prairie houses were constructed with a layered system, attempted to create a monolithic system with his usonian houses. Wright's desire to cut costs led to a consolidation of material and of craftsmanship. The interior and exterior materials were all the same and the structure was integral. Thus, there was need for only one level of craftsmanship, somewhere between rough and finish quality. The details of a monolithic system are rather simple usually, as the system itself is simpler. And the details tend to be naturally exposed.

The construction system used for this house, as explained earlier, has its own inherent opportunities and constraints which greatly affected the design of its details. First the site must be considered. We do not want to bring unnecessary equipment onto the site and it is relatively inaccessible. All materials must therefore be manipulated easily by two or three people. The people doing the majority of the construction will be my family: father, mother, brother and myself. None of us are very experienced as builders, but the labor is free, meaning that the building can take us as long as we want. Mistakes are expected. Cost is of course a consideration. Materials must therefore be affordable, but the labor required to manipulate them can be great. Fortunately, time is not a major constraint.

I think the results of these project-specific opportunities and constraints can readily be seen in my detail designs. The materials are almost solely wood; members are all of a size that can be moved and worked by one or two people. The methods of fabrication and manipulation are simple and easily accomplished with common tools. Almost all the joints will require much time and labor.



We resent calumny, hypocrisy and treachery, because they harm us, not because they are untrue. Take the deception and the mischief from the untruth, and we are little offended by it; turn it into praise, and we may be pleased with it. And yet it is not calumny nor treachery that does the largest sum of mischief in the world; they are continually crushed, and are felt only in being conquered. But it is the glistening and softly spoken lie; the amiable fallacy; the patriotic lie of the historian, the provident lie of the politician, the zealous lie of the partisan, the merciful lie of a friend and the careless lie of each man to himself, that cast that black mystery over humanity, through which any man who pierces, we thank as we would thank one who dug a well in the desert; happy in that the thirst for truth still remains with us, even when we have willfully left the fountains of it.

John Ruskin

## Meaning

The word meaning is defined as that which is expressed by language or is intended to be conveyed or indicated. Meaning has to do with: intention, purpose, and significance.

In architecture, then, we must be able to communicate meaning that is appropriate to the given project. We communicate that meaning with the use of some formal language. In architecture the language is comprised not of words but of forms.

Architectural forms can gain meaning by: conveying the method of assembly; conveying the function of the piece; the behavior of the form itself; association with other forms, related or unrelated.

**Assembly** The level to which one can gain knowledge of the construction is important to a building and is controlled chiefly by the details. I believe it is fundamental to architecture that its construction be legible—only in this way can we truly understand what the building is. If the construction is hidden from us our reactions can only apply to the surface, and in fact to the method of hiding the connections and structure that are allowing the thing to exist. For example, the large arch at Rowe's Wharf shows us none of its construction. The arch is not structurally an arch at all: the shape is constructed with a welded steel frame of rectilinear members; the curve is provided only by the cladding material. Here the form (arch) is



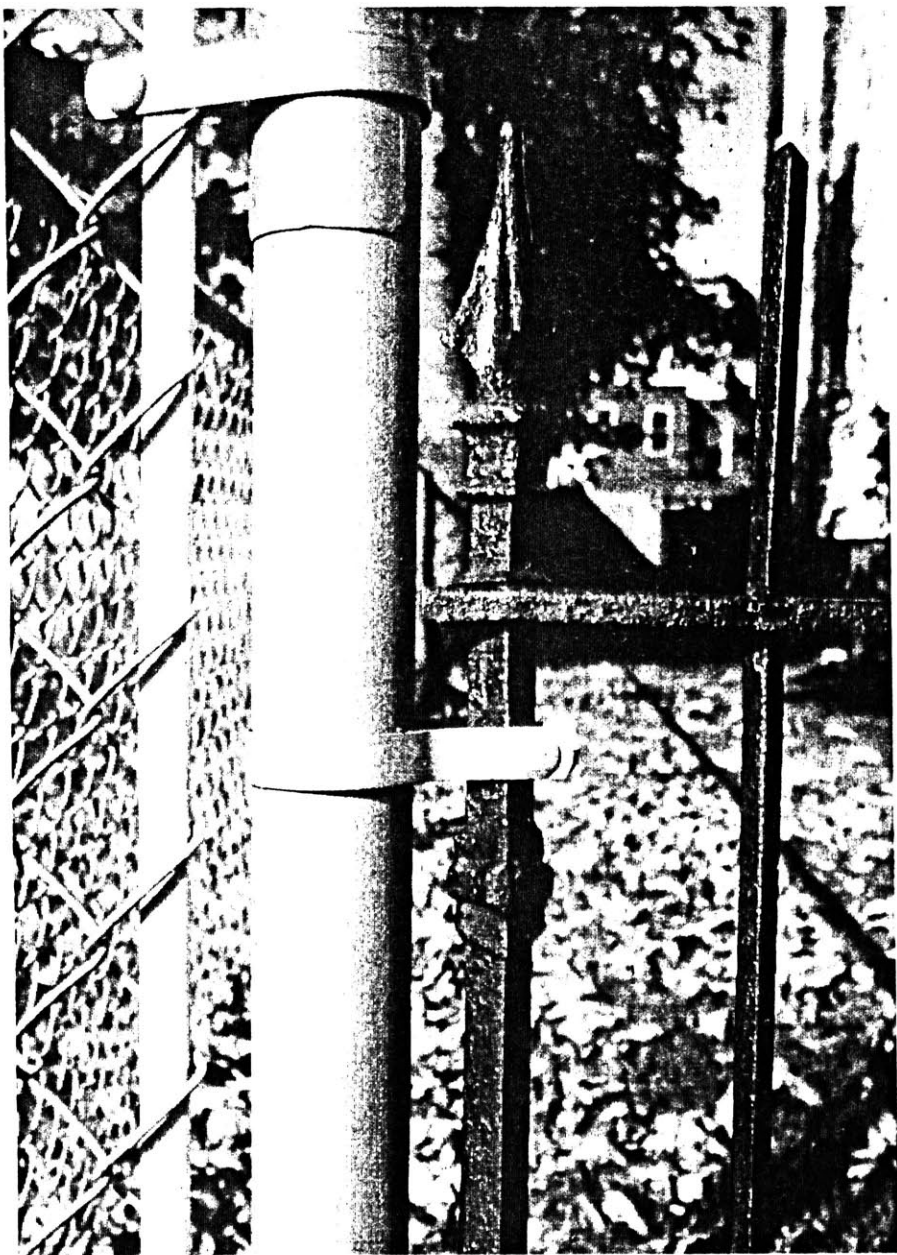
Instead of forcing the functions of every sort of building into one general form, adopting an outward shape for the sake of the eye or of association, without reference to the inner distribution, let us begin from the heart as the nucleus, and work outward. The most convenient size and arrangement of the rooms that are to constitute the building being fixed, the access of the light that way, of the air that must be wanted, being provided for, we have the skeleton of our building.

Horatio Greenough

not consistent with the structural system actually used, and then that structure is covered so that we have no knowledge of its making. If a building does not clearly and accurately convey its construction, the meaning it projects is falsity, deceit and a desire to affect only one's surface understanding of the architecture.

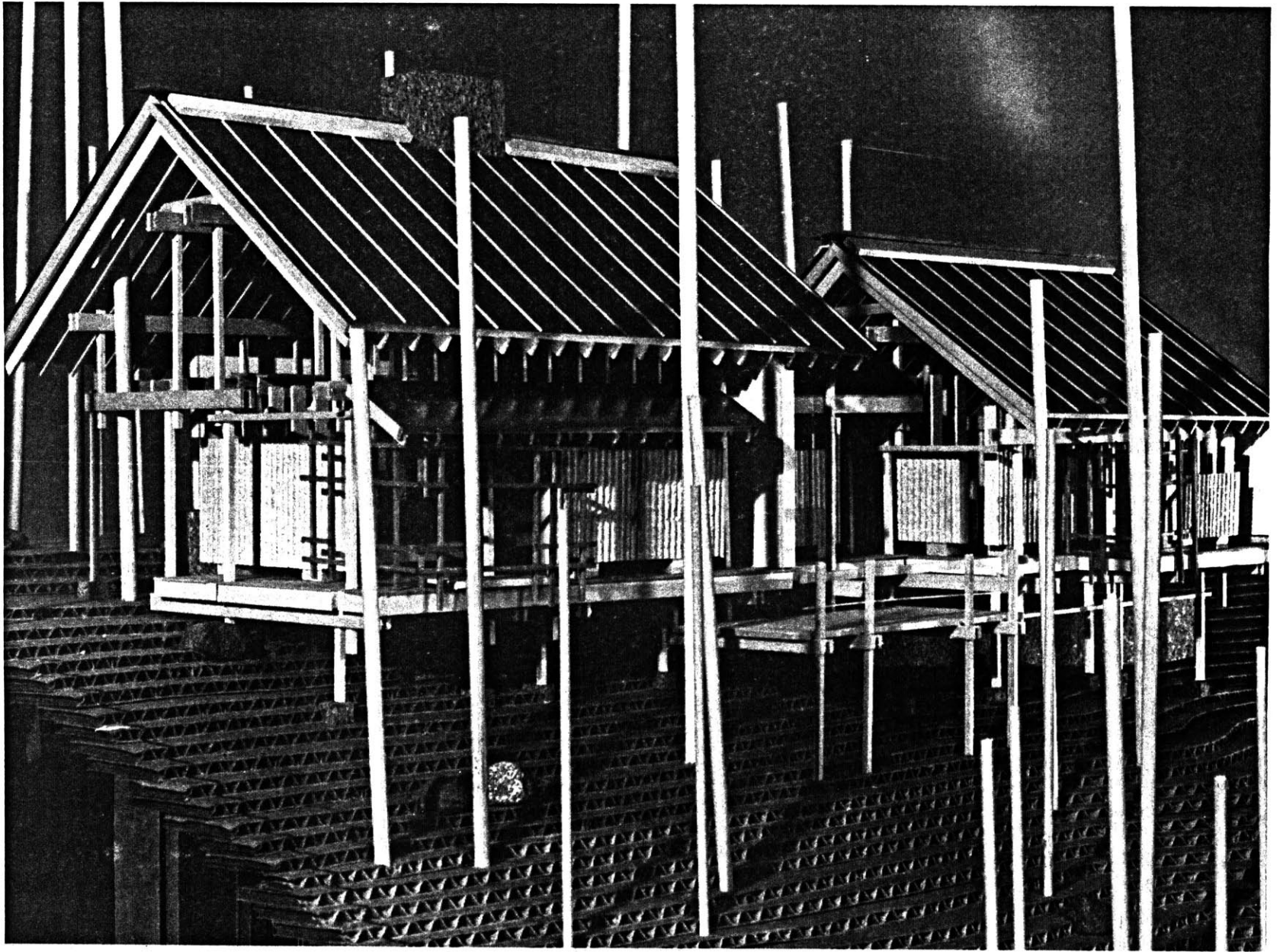
**Function** The conveying of the function of each piece, of each detail, greatly affects its subsequent meaning. The need for details arises out of the need to solve some fundamental problem--keep the rain out, or hold the beams in place. We must be able to comprehend the functions of the elements of any detail, how they carry loads or prohibit water infiltration. And the elements of architecture should all be related to some function. Detail is said to be the beginning of ornament and subsequently of decoration. The functional aspects of details gradually got lost until all that was left is mere decoration. Elements of architecture must retain their utility; they can be highly ornamental and fanciful, but if they are to have any meaning we must still be able to ascertain their function. The capitals of Greek columns are a good example. The function of the capital is to spread the load. This can be done with capitals that are Doric, Ionic, or Corinthian, and any choice is fine. But when a capital is made of plaster or plastic and is simply applied to the top of a steel column, the meaning is lost; or worse, it is false.

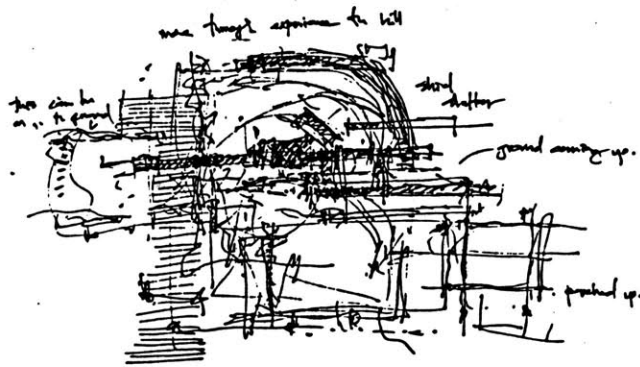




**Behavior** This is simply the way any given form is perceived. A circle or curve focuses attention inward; a straight line connotes movement along it; horizontals span; verticals support; etc. If we are cognizant of the behavior of forms we should be able to use these forms in manners consistent with the meaning we are trying to project. For example, the behavior of an interlocking joint is that the elements each give a piece of themselves in order that the bond be made. A third element is not required. The resultant meaning is that the elements are becoming one; by virtue of the interlocking form of the joint there is maximum contract, maximum association. In contrast, a detail that uses a third element to make the connection results in each piece clinging much more to its own integrity and in fact not wanting to be a part of the other.

**Association** Any form or detail will allow for some sort of association with other forms or details. This is accomplished through analogy, metaphor, or allusion. As designers we often hear, "that reminds me of..." or, "this room is like a dungeon." People associate the architecture with familiar forms, places, or experiences: these can be architectural, natural, biological--they can even be abstract thoughts. The important thing here is that we be aware of the associations that forms may evoke. Whether we consciously use association in the design process or not, the result will contain some associated meanings which will depend on the viewer and his/her level of sensitivity. If I mean a room to be light and airy and someone reads it as "dungeon," there is something wrong. If my work is compared to that of Wright or Scarpa I am complimented; if it is compared to that of Michael Graves or Graham Gund I am insulted. If this house in the mountains looks like a fortress, something is wrong.

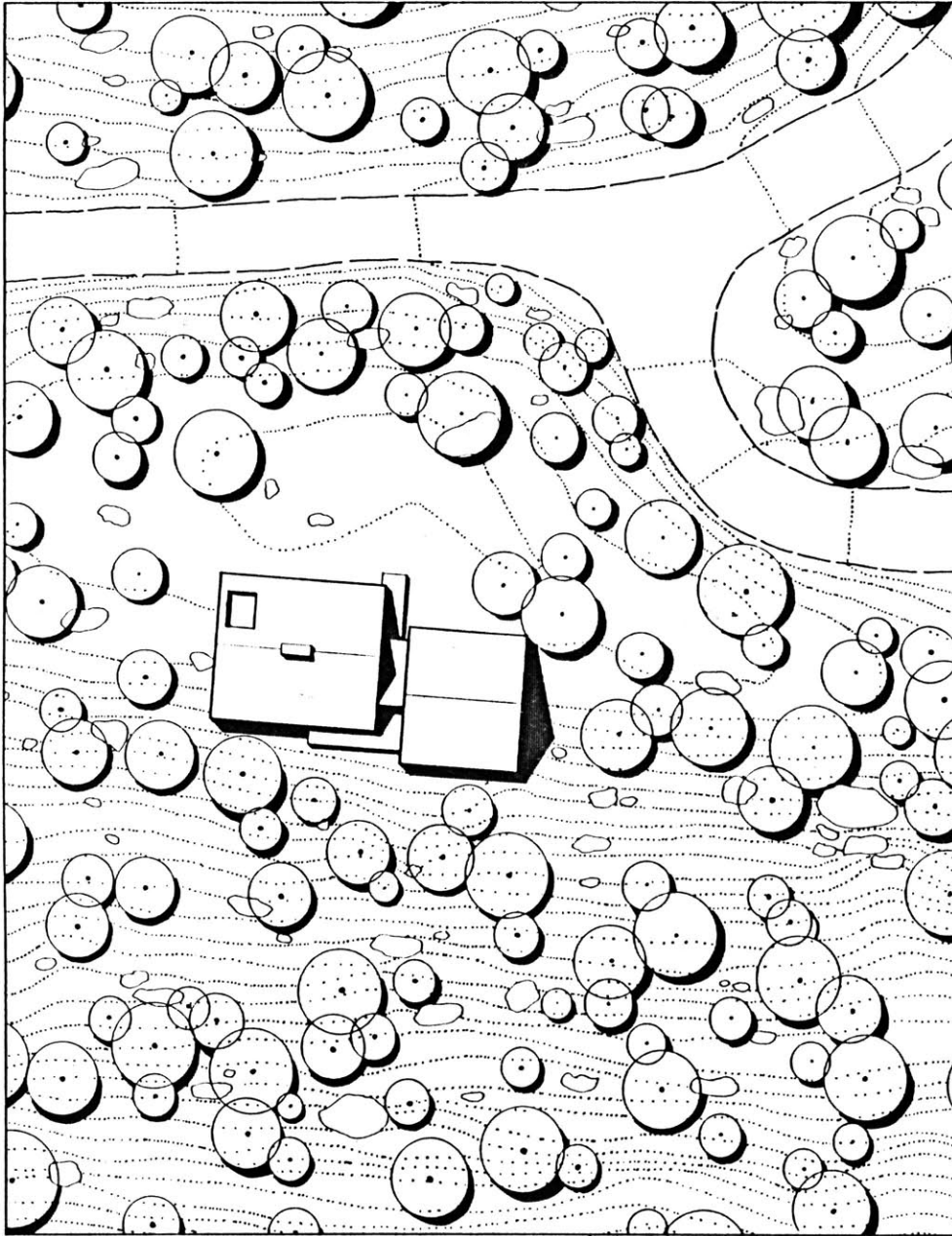




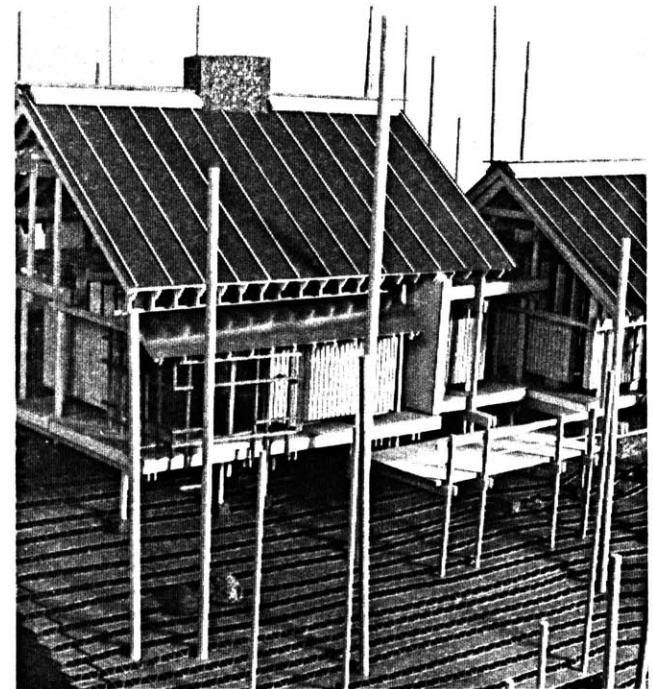
## House Design II

I began this thesis project with the notion that the design of the small elements of architecture could somehow inform the larger elements; that if a building was to be complete there must be an integral relationship of the part to the whole. The belief in this notion led to the need for two passes at the design of the house—one before the design of the details, and one after. This section presents the second pass.

I found that the design of the details can lead to decisions regarding the design of larger elements. If a project is to be complete and thus have a consistent language at every size, the issues that come up in the detail design may lead to a different understanding of the space that detail inhabits. This new understanding may then carry through to other situations and end up affecting the whole. If the detail is to be integral with the whole, this must be the case. All the systems—even if somewhat autonomous—must interact with and support each other. Think of structure, for example. If a building's structure is to be truly a part of the experience, it will inform the design and help define and build its spaces. The structure cannot simply be overlaid at the end of the process. Similarly with details—they must in fact be allowed to inform and characterize the places they inhabit.



Revised Site Plan



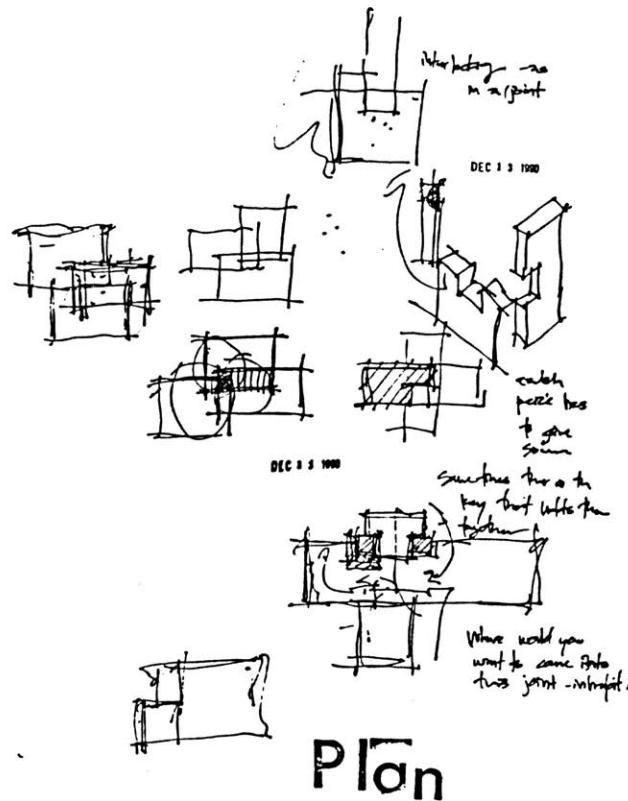


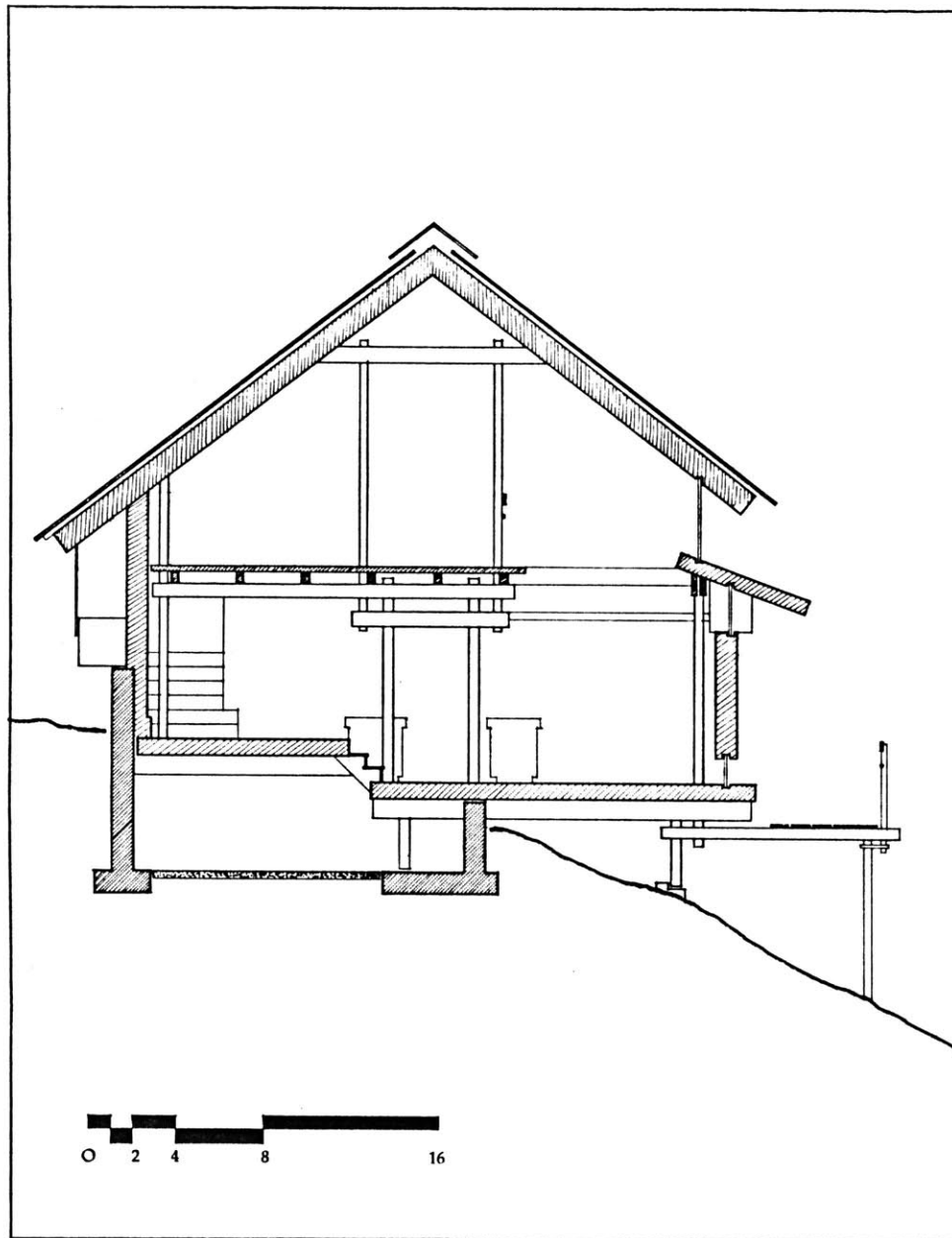
## Redesign

There are several reasons for taking another pass at the design. One was a desire to culminate the work of the semester in some final piece that would show how the details sit in the larger whole. Related to that is the need to provide some order to the work I had been doing at the detail scale. The major reason, though, was that the design of the pieces and their connections did in fact tell me something about the whole, and did lead to a different understanding of it.

The only way to really understand the relationship of the part to the whole is to experience the building itself. Maybe someday that will be possible. The next best thing is to model it as completely as possible, including at least the general character of the construction and its details. Here the model is at  $1/4"=1'0"$  scale, and while it does not show the detail explicitly, it does create a clear context and at least an image of what they may be like. Most of all the  $1/4$  scale model provides a chance to see it all together and test whether or not all the relationships are resolved.

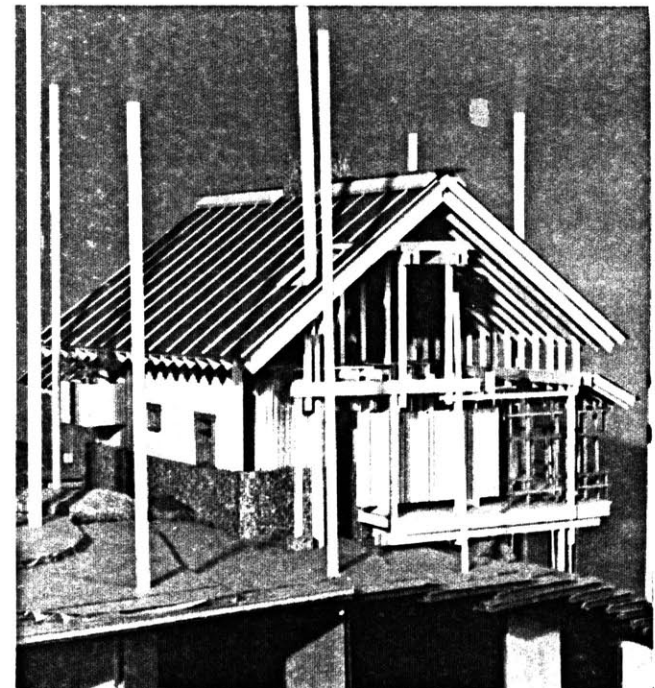
The design of the details, as presented earlier, became increasingly intricate and perhaps chaotic--the whole thing verged on being just too much. It was clear that there must be some order within which all this disorder could take place. There must be some relief from all the action. The  $1/4$  scale exploration led to the discovery of some of that order. The relief is provided by the ground form, the platforms, the frame, the roof, and to some extent, the walls. All the action takes place at the joining of these elements.



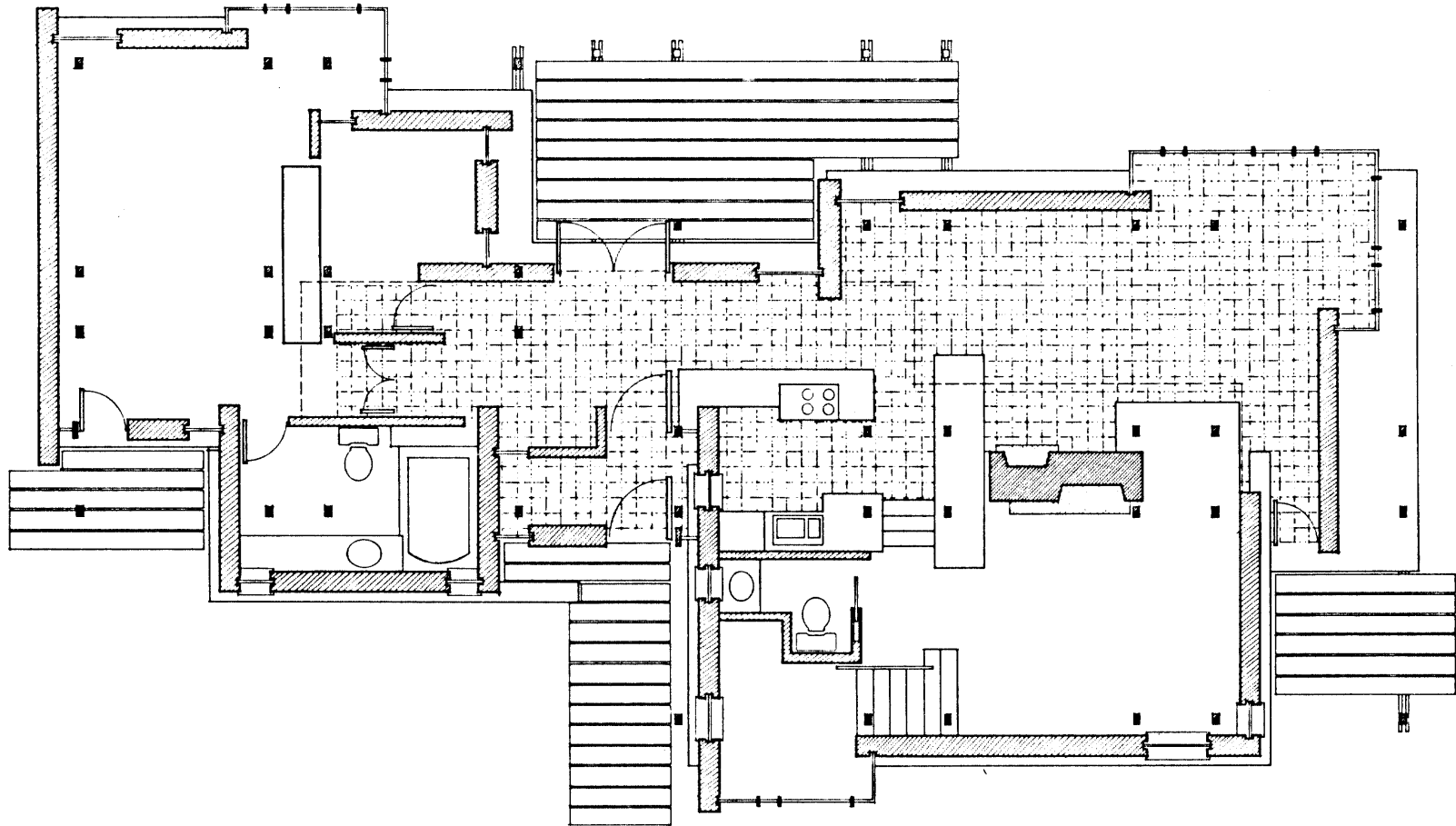
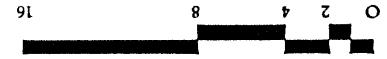


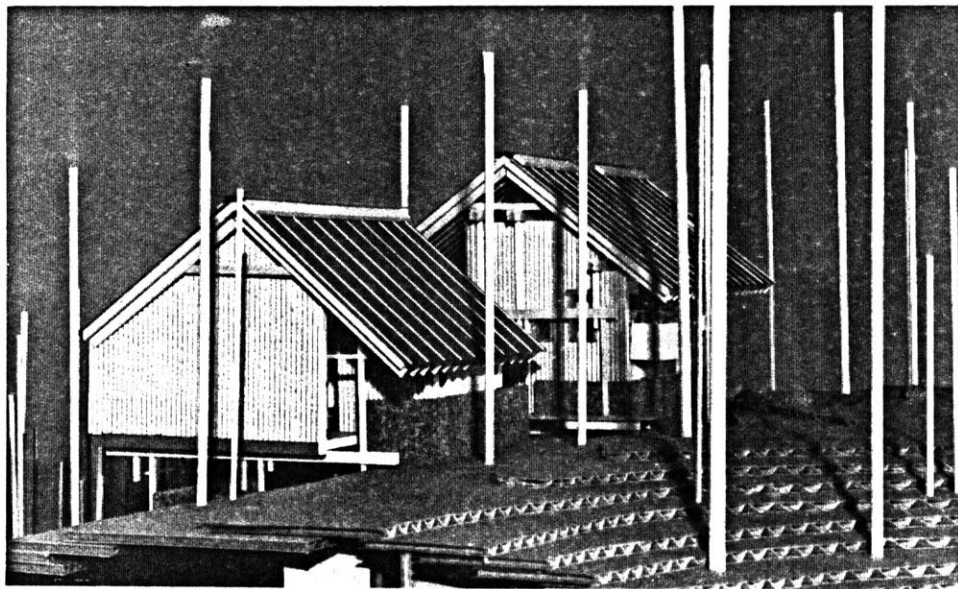
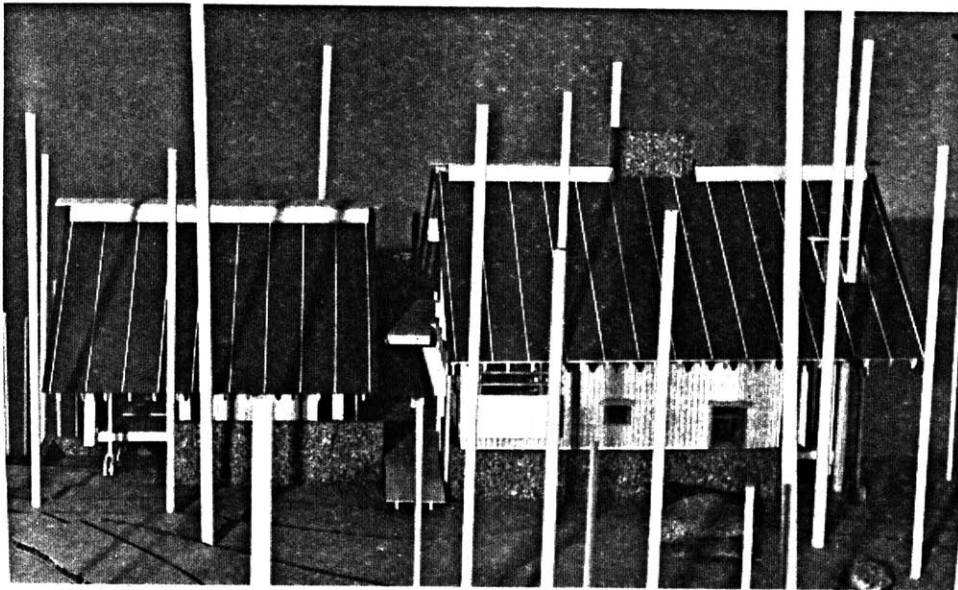
Revised East/West Section  
Looking North

Revised Floor Plan  
(facing page)









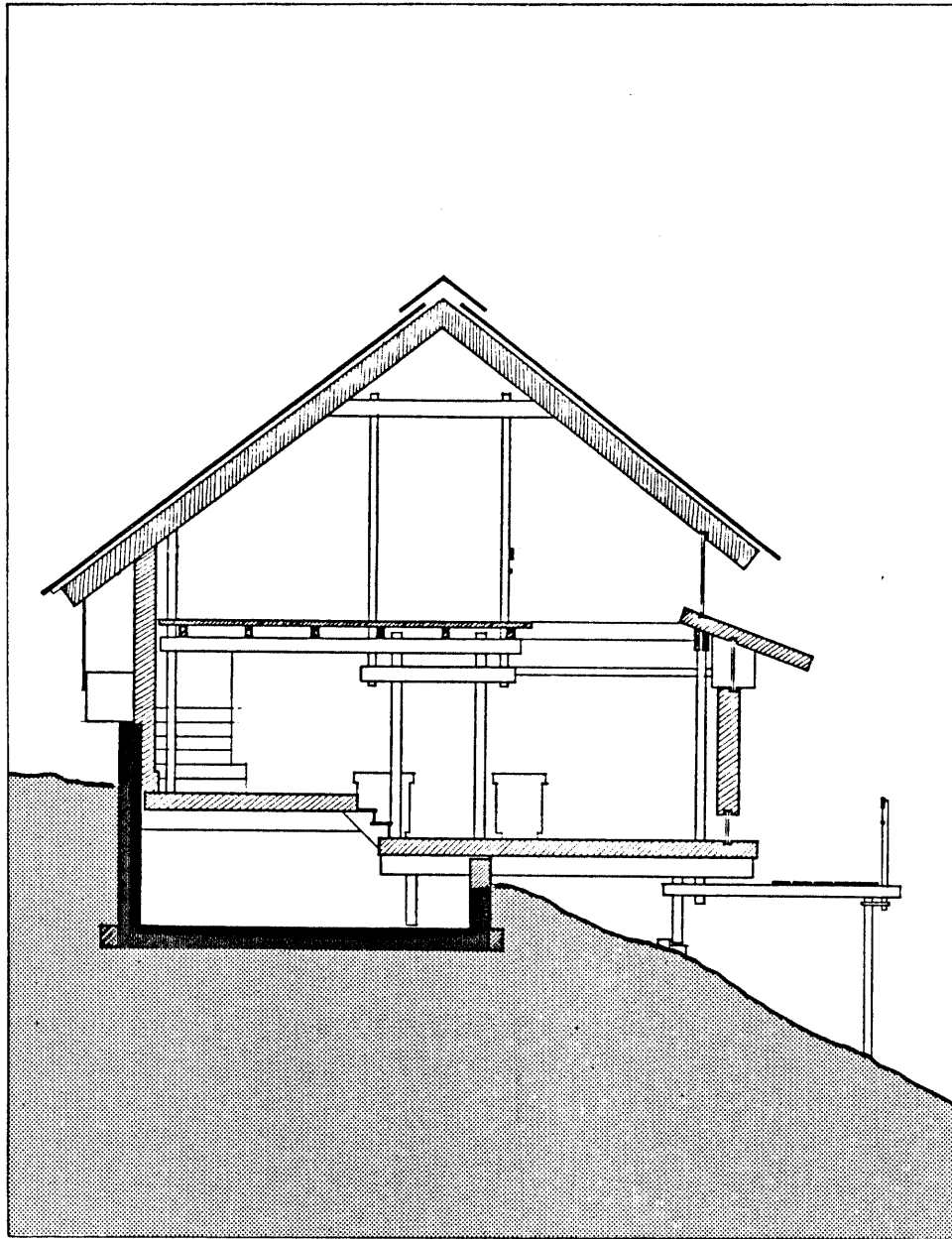
...the story of Rabbi Eisik of Cracow, which the Indianist Heinrich Zimmer took from Martin Buber's *Tales of the Hasidim*. This pious Rabbi, Eisik of Cracow, had a dream telling him to go to Prague, where, beneath the great bridge leading to the royal castle, he would find a buried treasure. The dream recurred three times, and the rabbi resolved to make the journey. He arrived in Prague and found the bridge, but it was guarded night and day by sentries, so that Eisik didn't dare to dig beneath it. His constant prowling finally drew the attention of the captain of the guard, who asked him in a friendly way if he had lost something. The rabbi, a simple man, recounted his dream. The officer burst out laughing: "Really, my poor chap," he said to the rabbi, "you haven't actually worn out all that shoe leather coming here simply on account of a dream, have you? What rational person would believe in a dream?" The officer too had heard a voice in a dream: "It went on about Cracow, telling me to go there and look for a great treasure in the house of a rabbi called Eisik, Eisik son of Jekel. I was supposed to find this treasure hidden in a dusty recess behind the stove." But the officer put no faith in dream voices; the officer was a rational man. The rabbi bowed very low, thanked him and hurried back to Cracow. He searched in the walled-up recess behind his stove and uncovered the treasure that put an end to his poverty.

Mircea Eliade

Happily there were several occasions when the development of some smaller pieces and their connections led to a questioning of some of the earliest design decisions. In one case even the siting and placement of the building was altered. Other situations simply led to a clarification of issues or spaces. At any rate, the possible relationship of the part to the whole has become clearer.

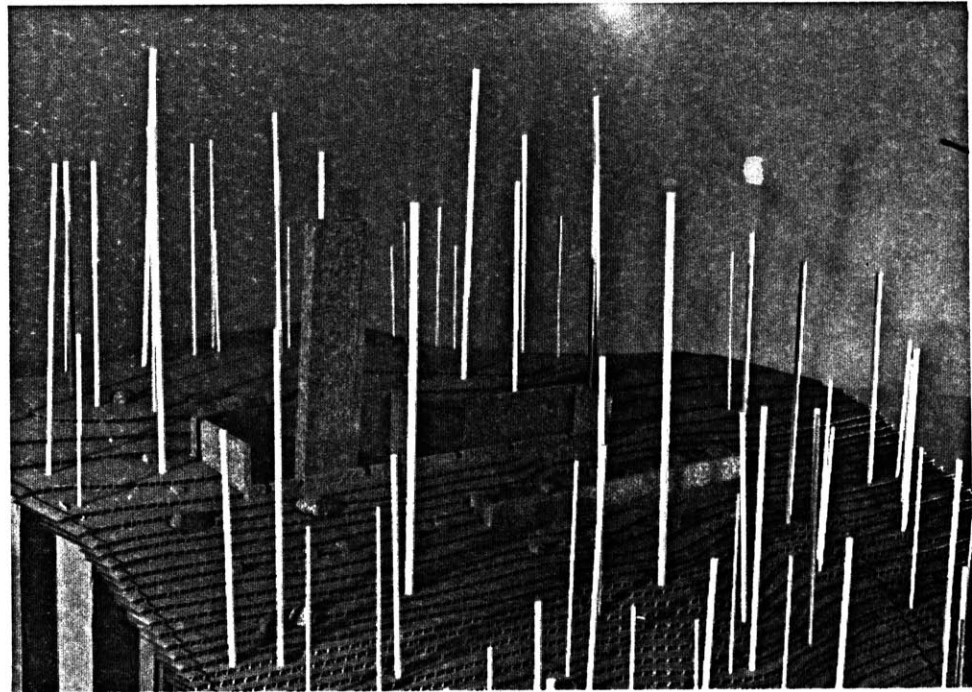
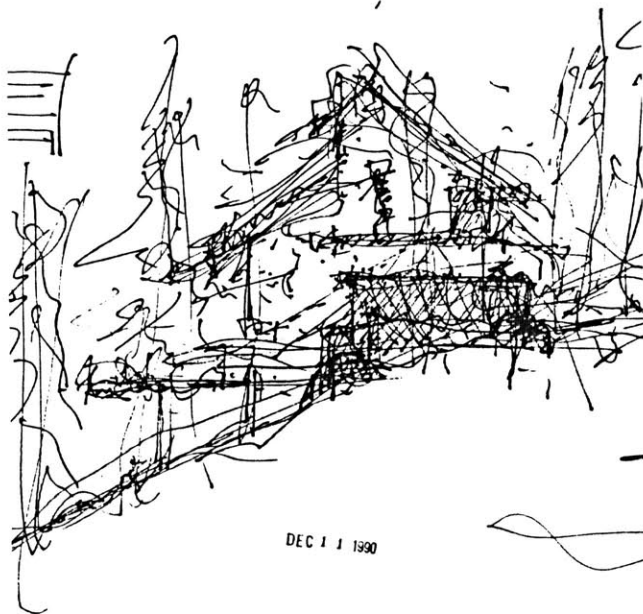
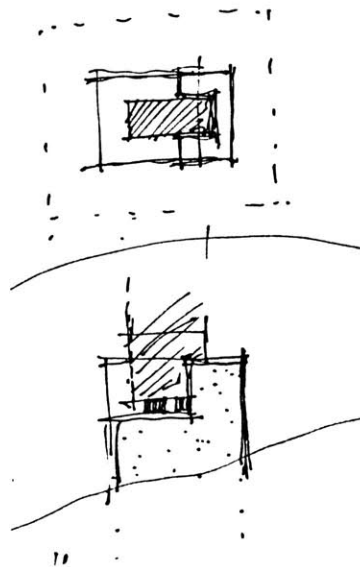
The design has actually changed in many ways, not all of which have to do with the details. Any time we take another pass at a design--whether we are happy with the previous or not--there will be changes. These alterations can occur due to new information about the project, a different attitude on the part of the designer, or in this case, from a fuller understanding of the details. Others are the result of feedback from my parents, as well as my advisers and the myriad of helpful student critics who grace this department. The plan and section of the house are therefore somewhat different at this stage.

The major components of the design and of the construction system did not change; nor did the basic organization. What changed was merely the arrangement of them. The system developed could in fact be used to create a wide range of possibilities. Any given vocabulary of formal understandings can be combined in different ways to solve various problems and create an array of opportunities. The design of the details led to not only a refinement of the systems but also to a clearer understanding of how they could be best used for this particular problem.



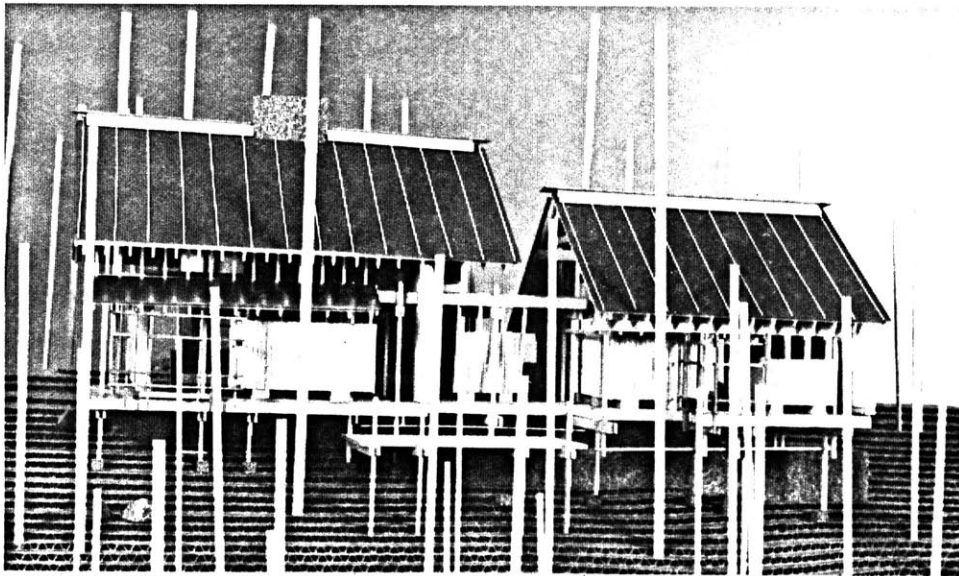
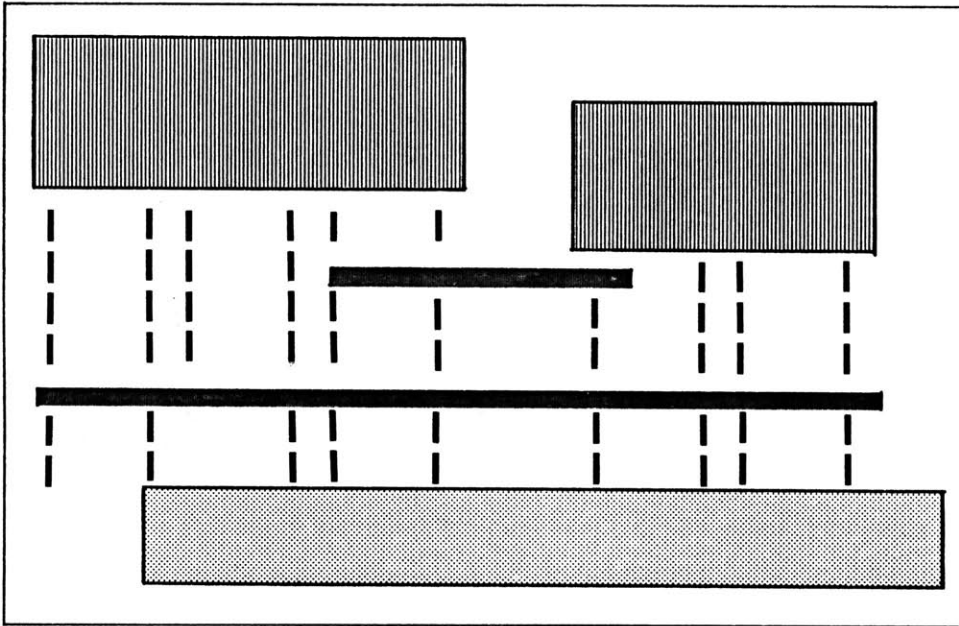
The differentiation of a single, certain simple form characterizes the expression of a building.

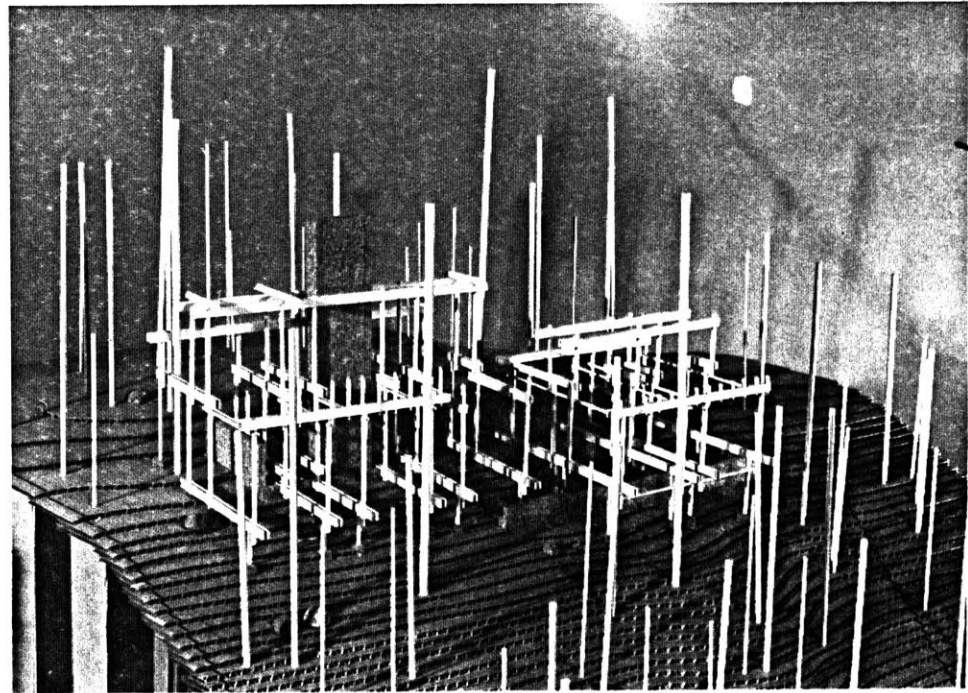
Frank Lloyd Wright



## Foundation

In the design of the details there is a consistent language used with regard to the hillside on which the house sits. The forms open up to the east and are protected on the west and north. This can be seen in the walls and their connections to the roof and platforms as well as the foundation. The concrete foundation designed for the posts was conceived as a seat for the post--a seat facing the view to the east. But the volume of the house sat up off the land. The second design puts the house into the hillside, using stone walls as the "seat" for the house itself.

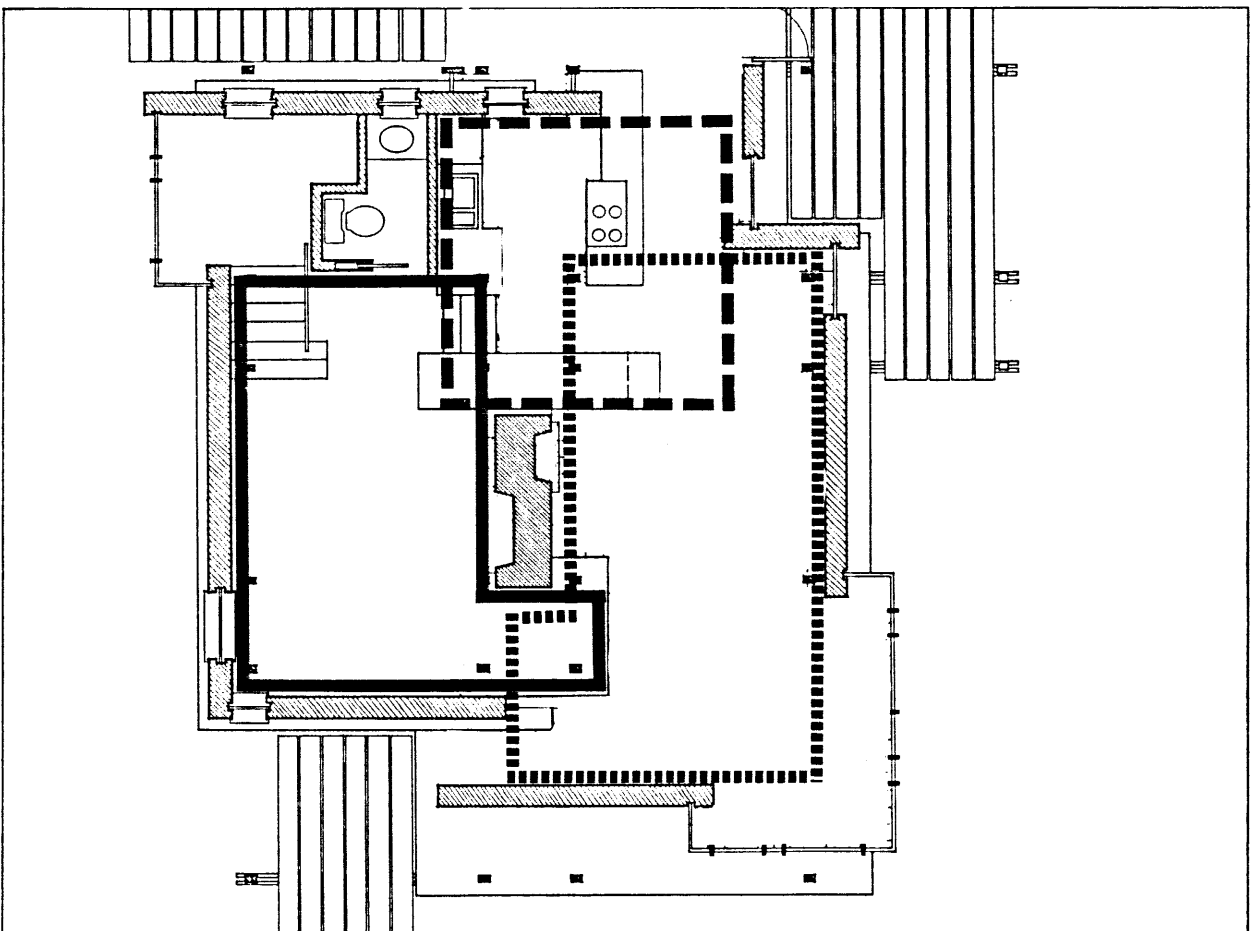


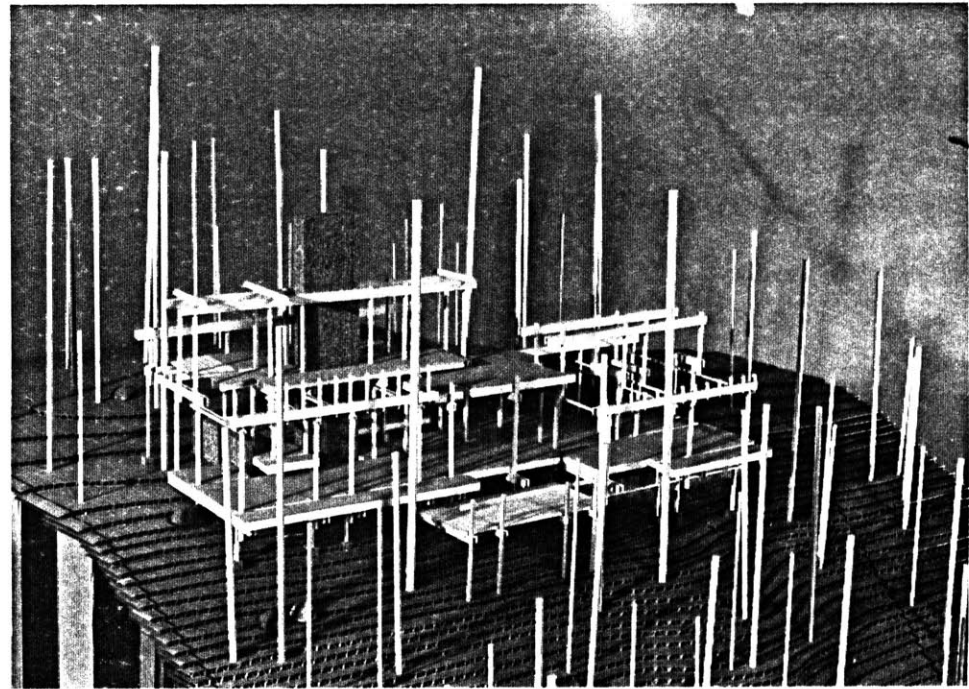


## Order

It became clear as I designed the details that they needed some strong order, within which they could be relatively free. In the second design this order is provided by: the roof as a large sheltering element; the stone foundation as a grounding element, giving the building a base on which to stand; the frame, whose repetitive vertical elements give rhythm and cadence; and the platform, on which the life of the building takes place. The result is a sort of sandwich: the bread (foundation and roof) provides a base for all the meats, vegetables and sauces (the details). The support is on the edges, the life in the middle.

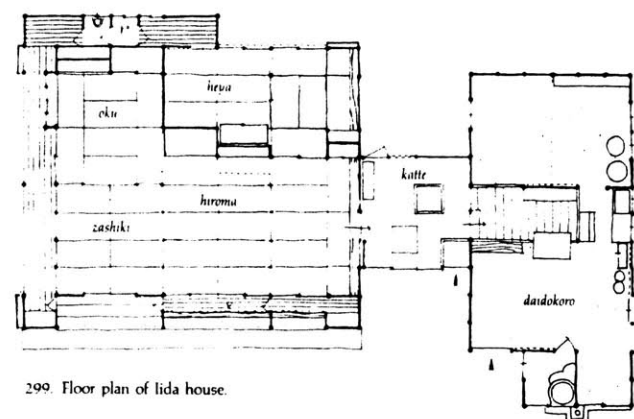
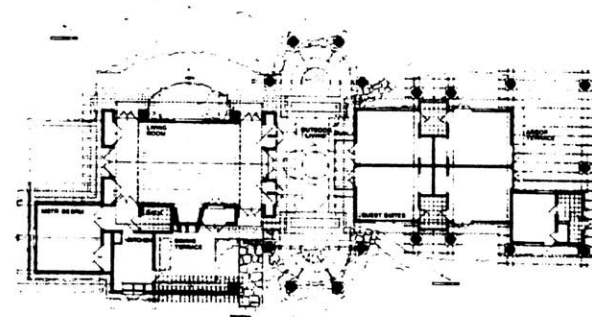
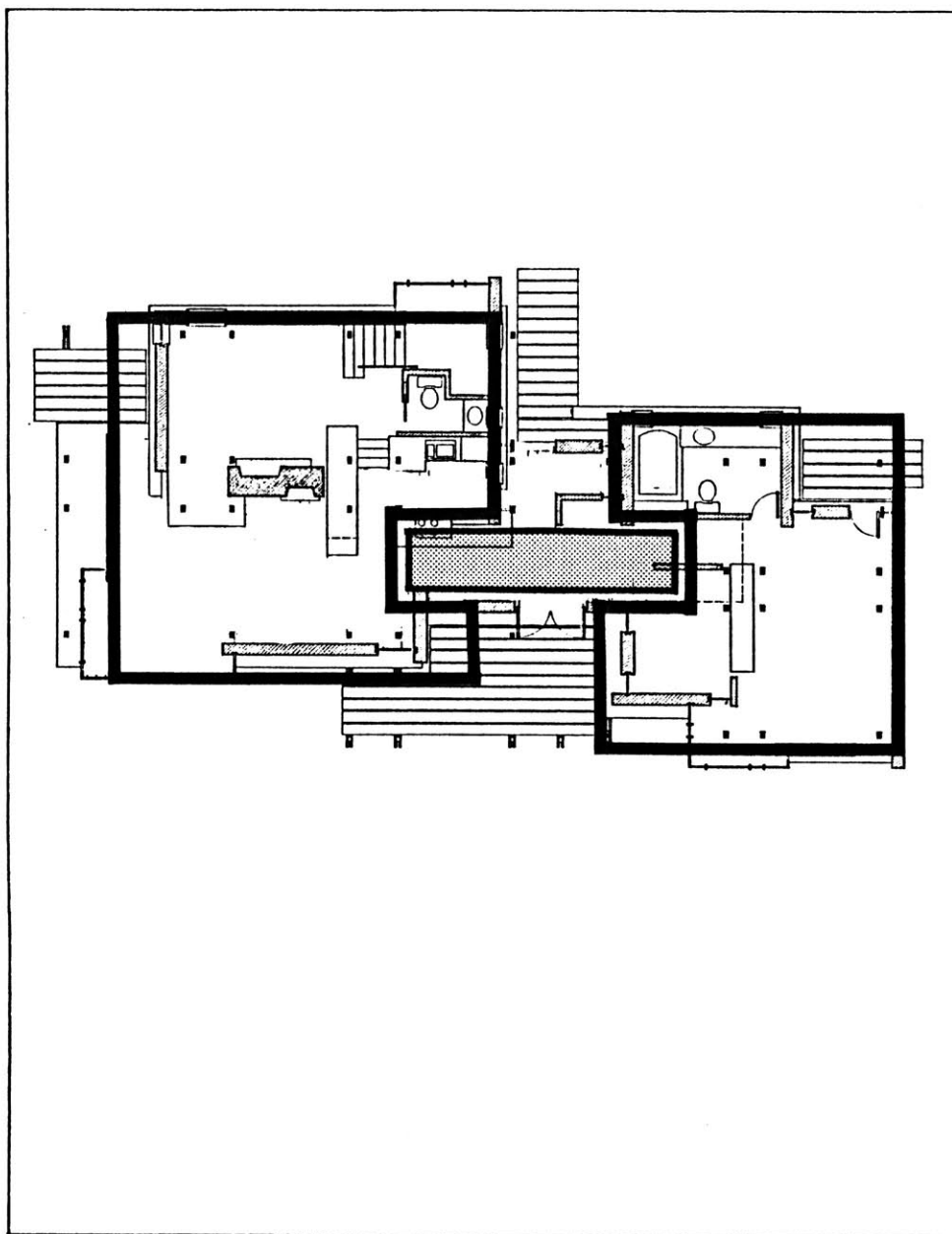




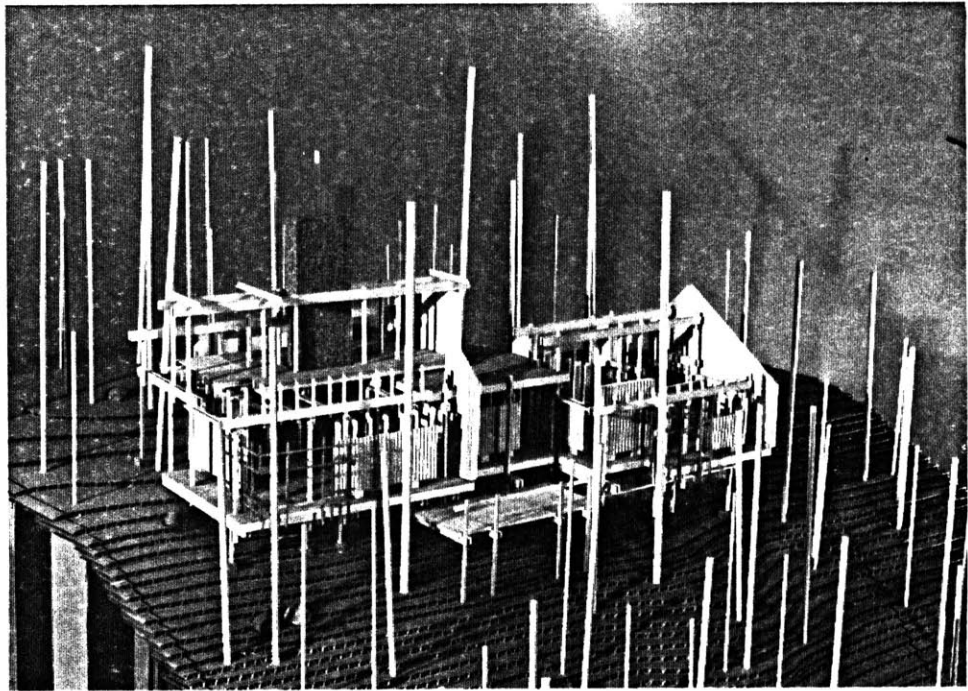


## Interlocking

Interlocking space has the same effect as interlocking materials. Each space is manipulated and arranged so that it locks into the next. Here the three spaces (living area, kitchen, and eating/work area) interlock with each other and in fact make a larger whole. The result is one large space which contains the three smaller spaces. Barriers are minimized, making communication easy between all three.



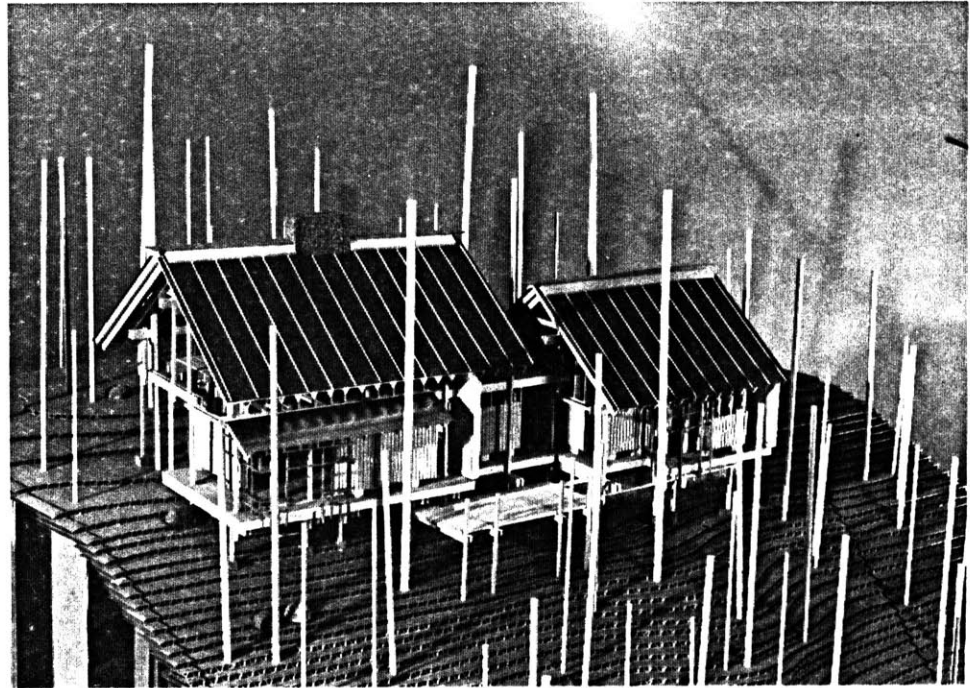
299. Floor plan of Iida house.



## Connector

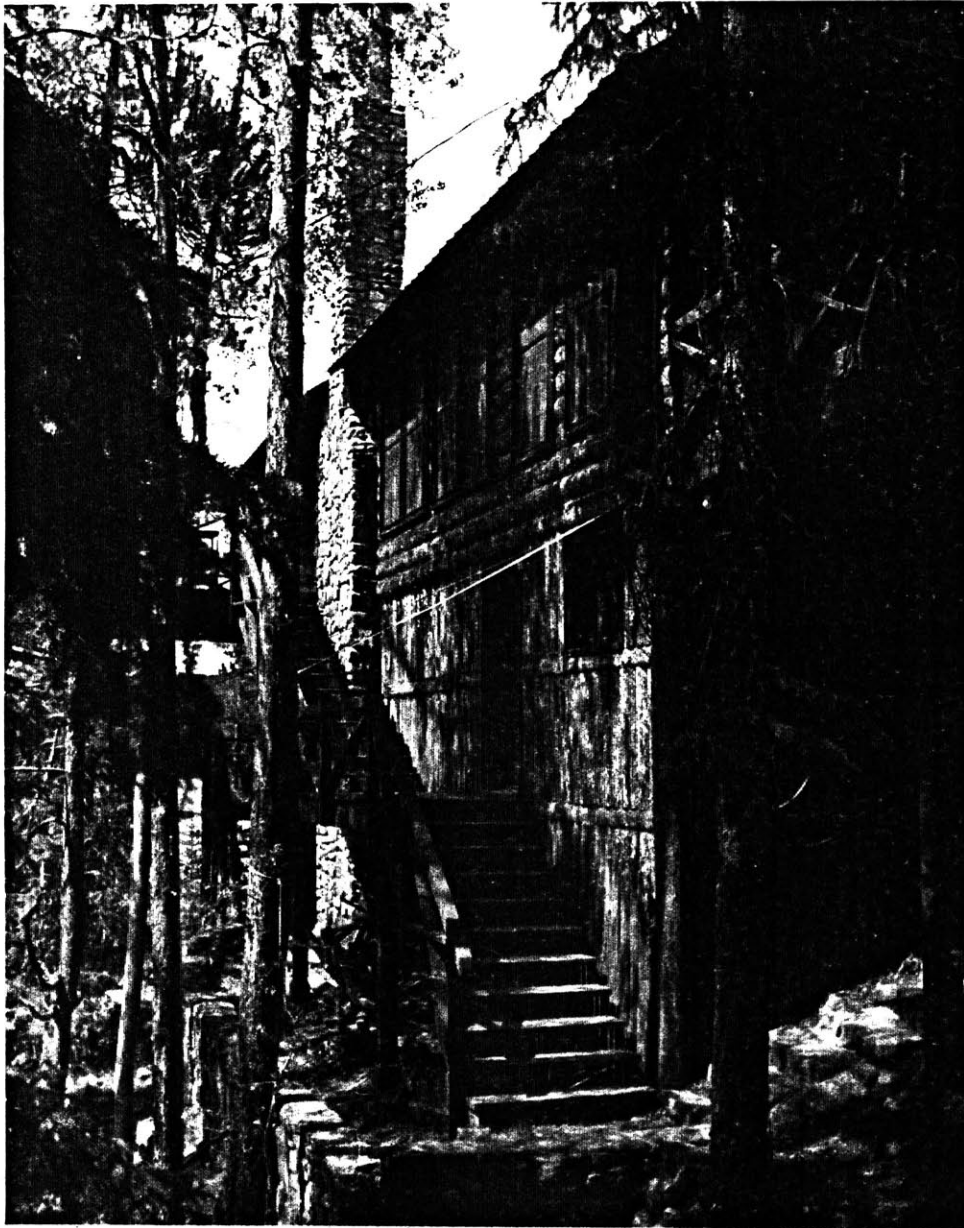
The two main volumes of the house are connected with another space--the entry. As in a detail, this connector allows the two elements being connected to maintain their integrity while being joined by a third. This third element (the entry) has an identity that is different than the other two: flat roof, separate ceiling, smaller size.





## Conclusion

Throughout this thesis I have attempted to demonstrate the integral relationship of the smaller elements of architecture to the larger. I have argued that through the design of the details one can gain understanding about the whole and that the details themselves do characterize and define the entire building. So I have discussed the importance of detail and where and how it fits in the design of a building. This process has made it clear to me that the issues of architecture are similar, if not the same, at every size.



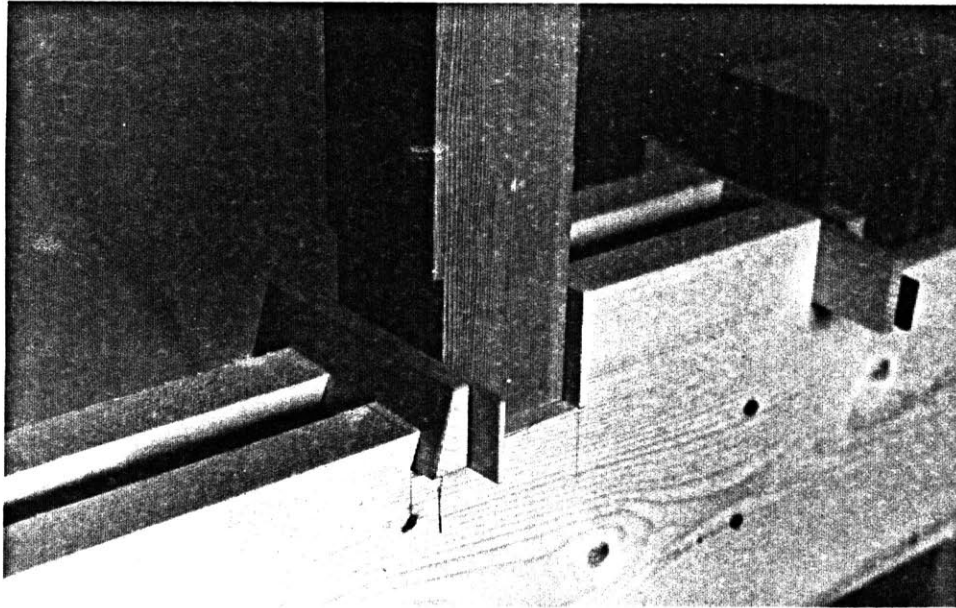
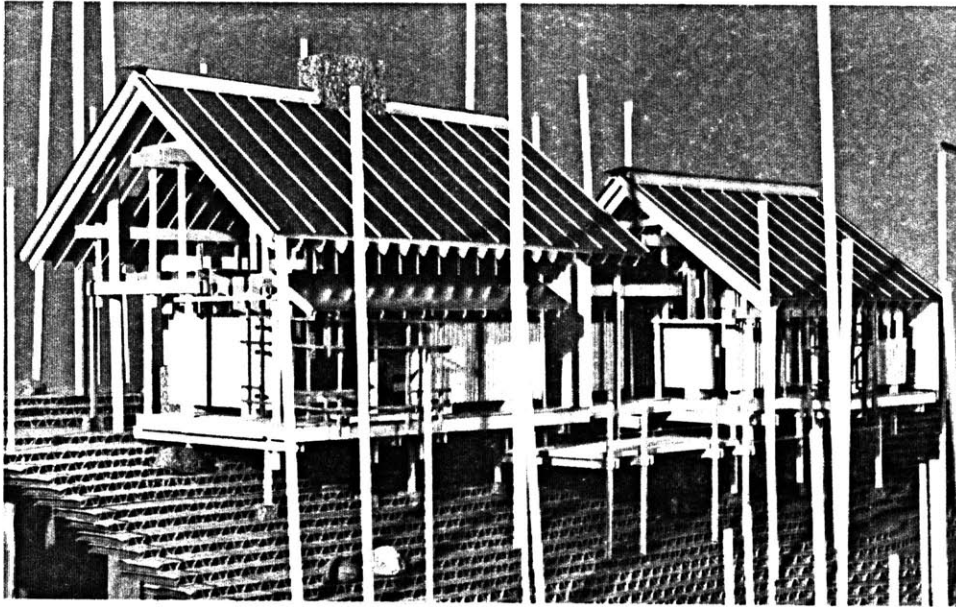
The greater part of what my neighbors call good I believe in my soul to be bad, and if I repent for anything it is very likely to be my good behavior.

Henry David Thoreau



Whether we are dealing with the issues at the city size or at the detail size, the issues and behavior of form are the same. Space, for example, can interlock in the same way that material can interlock. Interlocking spaces makes each individual section more a part of the others, and subordinates each one to the whole; each space must accommodate itself to the next. Interlocking material does the same: each piece is manipulated so that it can accommodate the other and the resulting fit is one that is as strong as possible, in fact to the point of making the elements act as one.

We can go back and review the criteria with which I designed the details and see that this is also an outline of a design methodology, and does not apply to detail alone. Because the formal issues are so similar at every size--so are the criteria we use to deal with these issues. The results can be seen in the work of two great architects. Wright's chairs, for example, are as uniquely Wright as his houses. Scarpa's details can only be in his buildings--out of context they might still be beautiful, but they make no sense. These architects have a consistent language of form at every scale, and I think that language is consistent because the issues and design methods used at every scale are similar.



Tell all the Truth but tell it slant---  
Success in Circuit lies  
Too bright of our infirm Delight  
the Truth's superb surprise  
As Lightning to the Children eased  
With explanation kind  
the Truth must dazzle gradually  
Or every man be blind---

Emily Dickinson

Mies Van der Rohe said "Der Liebe Gott Steckt in Detail"--God lies in the details. I take two meanings from this statement. One is the power of the detail and the other is its importance. Because details are small elements that solve large issues, they are powerful--we can handle them, focus on them, concentrate on them; if they are done well the details can help give us a deep understanding of the building itself. The importance of the detail is clear: without good detailing--work that is integral with the larger issues--a building is incomplete. I use as an example the work of Greene and Greene. Their California houses are recognized not for their innovative plans (because they in fact lack innovation) nor for their arrangement of forms. We admire their work because of the way it is built. It is the construction that gives these houses their appeal--not the spaces that are made but the way in which they are made, and how that making is evident. And it is the details which make this possible, while also adding another layer of information and of meaning. Recently it has been made known that some of their pegs and clasps served no real purpose and were in fact decorative. Where does God lie now? When I find out that these beautiful metal clasps are mere decoration my heart sinks --they become shallow and devoid of all meaning. The Greenes did not follow through to the smallest size and because of this, even the clasps that are real lose much of their significance.

We cannot be lazy if our buildings are to completely fulfill their functions and enhance the lives of their inhabitants. The Architecture must always be carried through to its smallest size.



## Credits:

page 3: Greene and Greene, Gamble House detail.

page 6: Carlo Scarpa, detail of connectors for colonettes on Banca Popolare di Verona.

page 16: USGS Map, Shadow Mountain, Colorado.

page 25: Frank Lloyd Wright, plan, Fallingwater.

page 64: Carlo Scarpa, sketches for support, Brion Cemetery Pavilion.

page 74: Greene and Greene, beam connections, Gamble House.

page 94: (top) Bernard Maybeck, James J. Fagen House.

page 94: (bottom) Chuji Kawashima, Japanese Folkhouse, Minka.

All other photographs and drawings by the Author

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*“If we do not succeed, then we run the risk of failure”*  
— Dan Quayle



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